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ABSTRACT

This handbook is designed to aid educators in implementing The Wisconsin Guide to Local Curriculum Improvement in Industrial Education, K-12. It is not a course of study but an aid to implementing research and development activities into local industrial education programs. The book contains the following three sections: (1) seven content outlines--different ways of looking at and structuring the research and development/creation process; (2) learning activities keyed to the learning objectives of the Wisconsin Guide--in areas such as graphic communications, materials and processes, industrial management, energy and transportation, inventive technology: and (3) resources--sources of publications, films, addresses, and people who can help to improve local programs. (KC)

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RESEARCH & DEVELOPMENT

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HANDBOOK

THE WISCONSIN GUIDE TO
LOCAL CURRICULUM IMPROVEMENT
IN INDUSTRIAL EDUCATION, K-12

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PREFACE

This handbook is intended to aid industrial educators in developing research and development activities into their programs. The Research and Development Handbook is not a course of study, but rather a resource to aid in local improvement. It is designed to be used by educators to aid them in implementing The Wisconsin Guide to Local Curriculum Improvement in Industrial Education, K-12.

The content outlines, models, structures and activities can be utilized for courses, specific units or for integrating research and development concepts throughout the industrial education program.

The materials included in this handbook come from a number of excellent resources that have been developed to improve research and development education. Where the sources were known credit is given for inclusion.

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RATIONALE:

A rationale is a reason for existence or prepared action. In curriculum development it answers the key question of "why" something is taught.

A rationale is thus a justification statement which highlights the importance of the program, course or unit which it is directed at.

The statement is generally short, concise and directly to the point. The rationale that follows in this resource handbook provides the user with a set of ideas to use in developing a statement for local use.

RATIONALE

To be contributing members in their society, individuals must have a knowledge and understanding of the world in which they live. Since industry is such a potent force in this world, it is essential that we provide for its study. Thus we find the underlying principle of Industrial Education, the understanding of industry and its technology. Industrial Education has always placed emphasis on mastery of the skills required in industry.

The increased complexity of technology and society results in a need to constantly update old and develop new ideas, processes and products. The research and development function is a major element in industry. Billions of dollars are spent each year by business and industry to develop new ideas, discover new knowledge, to improve methods of production and to develop new and improved products and services. In 1975, General Motors spent more than one billion dollars on research and development activities itself, while the top five corporations combined to spend nearly three billion dollars.

Research and development require the ability to systematically identify problems, collect information and data, and propose and test solutions using analytical methods. It is important for individuals to develop these abilities for personal and occupational uses. Research and development represent a viable approach to studying industry and technology, yet Industrial Education has a tendency to overlook this as an important content area. As a content area within Industrial Education, it represents an alternative approach in preparing youth for technological change. Research and development deserves a high priority as the industrial education curriculum adapts to changing needs.

CONTENT OUTLINES:

Content in any curriculum area can be structured in many different ways. In addition, the manner in which the content overview is communicated to other professionals can take on a variety of approaches.

Common approaches for communicating a curriculum structure, scope and sequence are usually in the form of outlines, models or a combination of the two.

The content structures that follow in this handbook are examples of different ways of communicating the subject to the profession.

THE FOLLOWING DESIGN PROCESS WAS TAKEN FROM THE BOOK, THE UNIVERSAL TRAVELER. MODELS ARE ALSO AVAILABLE FOR SOLVING PROBLEMS AND INCLUDE THE SCIENTIFIC METHOD AND VARIOUS DESIGN PROCESS ELEMENTS BY LINDBECK, EARLE, HILL AS WELL AS OTHER METHODS THAT CAN BE USED.

The normal, logical sequence of events included in the design process is:

accept situation

To state initial intentions. To accept the problem as a challenge; to give up our autonomy to the problem and allow the problem to become our process.

analyse

To get to know about the ins and outs of the problem; to discover what the world of the problem looks like.

define

To decide what we believe to be the main issues of the problem; to conceptualize and to clarify our major goals concerning the problem situation.

ideate

To search out all the ways of possibly getting to the major goals. Alternatives.

select

To compare our goals as defined with our possible ways of getting there. Determining best ways to go.

implement

To give action or physical form to our selected "best ways".

evaluate

To determine the effects or ramifications as well as the degree of progress of our design activity.

SOURCE: Universal Traveler, Don Koberg and Jim Bagnall, William Kaufmann, Inc., One First Street, Los Altos, CA 94022

IDEATION is the process of getting good ideas. Ideas don't just happen; in most cases, ideas are made to happen. Listed below are some techniques which can be used to solve problems or to stimulate thinking. The technique is listed with a brief description of how it is used in the process of ideation.

Brainstorming

A brainstorming session will involve the gathering together of one or more persons to explore creative ideas about a subject. Ideas are exchanged which, in turn, stimulate thinking of other ideas which can stimulate wild ideas from someone else. This is a creative experience which can engender novel approaches to a problem. Rules usually followed are to think first - judge later. Quantity of ideas, not quality, are needed. Evaluation comes later.

Lists

It is often useful in a design process to make questions and answers for anything and everything related to a problem. By themselves, the checklist creates action-reaction and can stimulate solutions. Lists can become a record as ideas are added or as a problem unfolds; and they can easily be re-arranged in several ways to approach the problem from different views.

"AH-HA"

This step usually follows a deep immersion into the problem and the studying of all the parameters that exist. The mind becomes like a sponge to soak up all the pertinent information needed prior to the "AH-HA" step itself. Then the incubation phase allows the mind to concentrate on other things which puts the problem into your subconscious mind and keeps it there. One day the solution will come to you; perhaps, in your sleep or during some other activity.

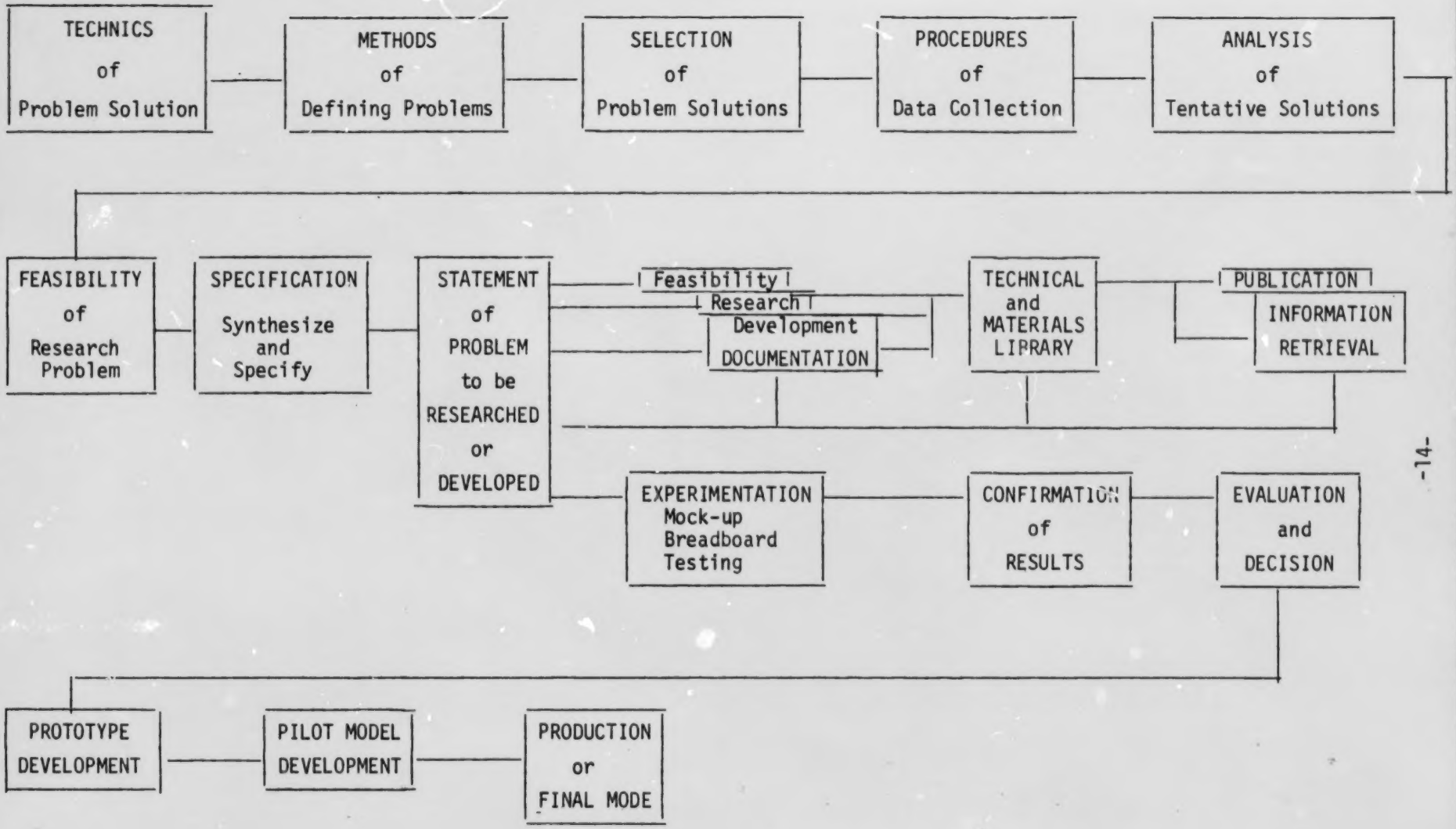
PROJECTION

"Put yourself in someone else's shoes" states this concept concisely. It often helps to change your point of view when solving problems for someone or something other than yourself. Projection is the practice of seeing problems not from within, but from the correct perspective.

A number of other methods which can be effective in the ideation process include the following:

1. Trial & Error
2. Jump In
3. Bionics
4. Change

FUNDAMENTAL STRUCTURE OF PRODUCT RESEARCH AND DEVELOPMENT



SOURCE: Dr. Douglas Stallsmith, Professor
University of Wisconsin-Stout
Menomonie, WI

DR. DOUGLAS D. STALLSMITH
225B APPLIED ARTS BLDG.
UNIVERSITY OF WISCONSIN-STOUT

RESEARCH AND DEVELOPMENT

(Course Outline)

1st Week

Introduction to course
Outline of organizational procedures
- Information form
- Fees
- Notebooks

Outline of course
Safety procedures
Creativity problems
- Conscious developing of rational powers — Creativity problems

2nd Week

What is research and development?
History of R & D
- Reasoning
- Action research — Examples of reasoning

R & D in industry
- The part R & D plays
- Basic structure
- Composition of industrial research
- Manufacturing research — Report on research in industry

The choice and statement of a research problem
- Problem in pure science
- Problem in applied science
- Cost
- Questions

Searching literature
- Necessity
- Structure of scientific literature
- Suggestions for searching
- Notes & indexes

3rd Week

Fundamental structure of R & D

Techniques of problem solution

Scientific method — Problems

Brainstorming — Individual & Group

Idea tracking

Value analysis

Production planning

Methods of defining problems

Analysis & synthesis

Selection of problem solutions

Hypothesis

Testing hypothesis

Procedures of data collection

Analysis of tentative solutions

Feasibility of research problem

Specify

Statement of problem

Feasibility

Research

Development

Technical & materials library

Experimentation

Mock up

Breadboard

Testing

Confirmation of results — Selection of problem

Evaluation & decision — Begin research

Prototype development

Pilot model development

Production or final model

4th Week

Material research	Handout sheet
Basic materials	
Processed materials	
Components	
Separation of materials	Handout sheet
Wedge	
Wedge W/ chip	
Chip	
Contour change	Handout sheet
Addition of materials	Handout sheet
Internal change	Handout sheet
Materials technology	Handout sheet
Monolithic, inert entities	
Natural	
Raw	
Basic	
Composites	
Sandwich	
Dynamic systems	
Materials of tomorrow	Report on some new material

5th Week

How decisions are reached	Handout sheet
Factors	
Conclusions	Work on problem research
Design work sheet	Handout sheet
Recognition	
Definition	
Preparation	
Analysis	
Synthesis	
Evaluation	
Presentation	
Check list for problem solving	Problem on design

6th Week

Technical reports
- Importance
- Types of reports
- Organization of reports
  - Title & abstract
  - Text
  - Acknowledgments
  - Notes and references

Oral report on problem

7th Week

Discussion of problems

Work on problems

8th Week

Design of problem
- Specifications
- Improvisation verus planning
- Accessibility & demountability

Work on problem

9th Week

Discussion of problems

Work on problems

10th Week

Design of problem
- Test facilities
- Use of standard parts
- Interconnection of adjustments
- Automatic recording & other automatic mechanisms

Work on problem

11th Week

Design of problem
- Some causes of failure

Work on problem

12th Week

Troubleshooting — Work on problem
Report on problem

13th Week

Discussion of problem — Work on problem

14th Week

Discussion of problem — Work on problem

15th Week

Discussion of problem — Work on problem

16th Week

Discussion of problem — Work on problem

17th Week

Review report procedures — Work on problem

18th Week

Semester reports due on problems

19th Week

Re-Evaluation of problem
Necessary revisions — Work on problem

20th Week

Discussion of problem — Work on problem

21st Week

Further research & development — Work on problem

22nd & 23rd Week

Discussion of problem — Work on problem

24th Week

Report on development

25th thru 29th Week

Discussion of problem — Work on problem

30th Week

Report on development

31st thru 34th Week

Discussion of problem — Work on problem

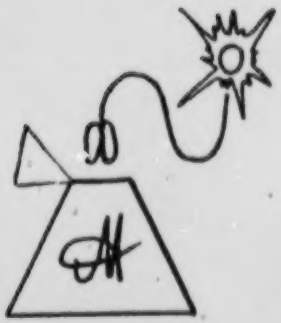
35th Week

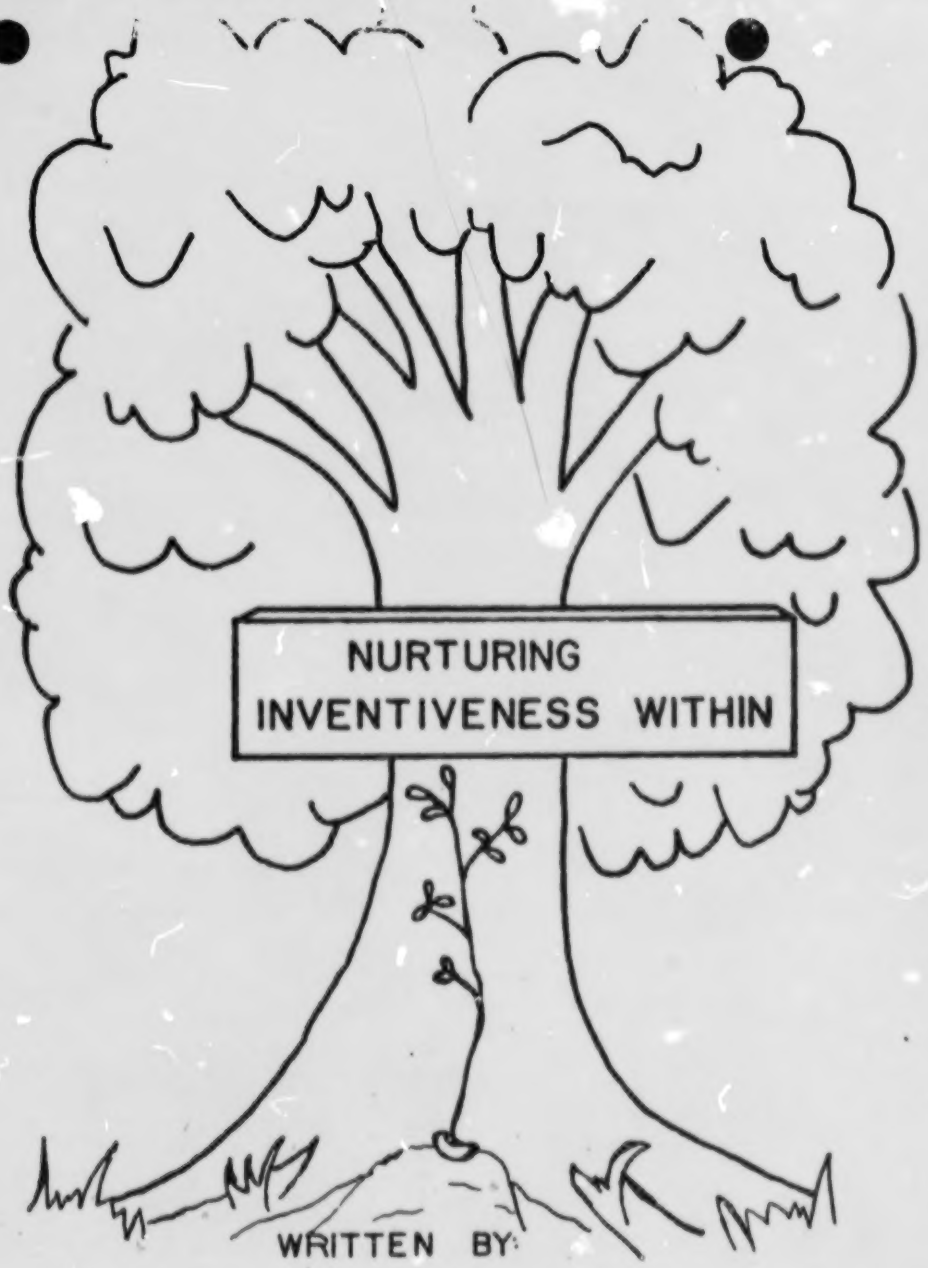
Begin final report

36th Week

Approval of report
Binding of report

Two booklets are enclosed for ideas for further study.





WRITTEN BY:

ANN MARIE HINTERBERGER

NURTURING INVENTIVENESS WITHIN

written by:
ANN MARIE HINTERBERGER

illustrated by:
ANN MARIE HINTERBERGER

1st edition © 1979

presented to:
The 1979 American Industrial Arts Association Convention

San Antonio, Texas

DEDICATED TO

GRAMMA MARY GULICK AND
GRAMPA PERRY

two very wise people in my life
who saw my mission before I did

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NURTURING INVENTIVENESS WITHIN...

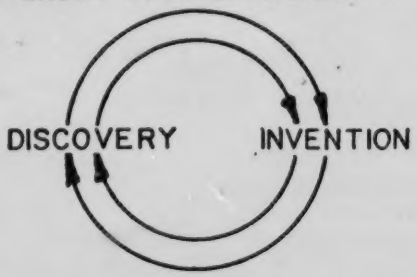
Purpose

The purpose of this booklet is to serve as a Birds Eye Veiw of the role inventors and inventions can and do play in our Society. It also serves as an initial reference guide for further investigation for the reader, and because I would like to see the information we are capable of giving and receiving stay alive.

WHAT IS INVENTION ???

‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡‡

...it is the seed of a new idea... conceived in the mind before gestation into the material world. Essential to invention is DISCOVERY" This is the first phase of the learning process. Here one experiences making new connections between that which is strange and associating with the familiar. It is then the ability to break these familiar connections once again in order to produce more unique ideas which is known as...INVENTION""



INVENTION and DISCOVERY are KEYS TO our continuous GROWTH and ADVANCEMENT as a

"""

""HUMAN RACE""

INVENTION IS""

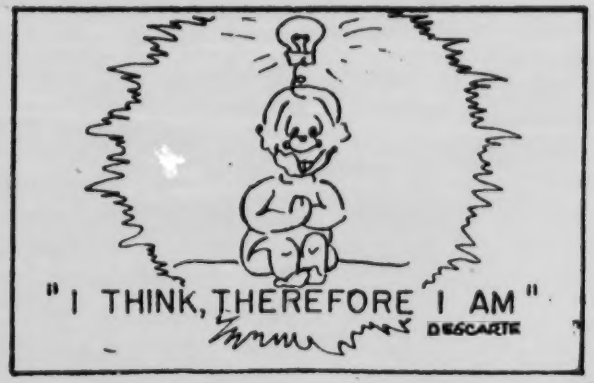
‡‡ APPLIED DISCOVERY

‡‡ UNIQUE APPLICATION OF INFINITE POSSILILITIES

‡‡ A PREDICTION OF WHAT MIGHT BE

‡‡ A PRACTICAL INQUIRY INTO THE REALM OF POSSIBILITIES

‡‡ MAKING THE FAMILIAR STRANGE



WHO ARE INVENTORS???
****

** those WILLING to take the RISK...

** those DESIRING TO IMPROVE and REDESIGN that which is perceived incomplete or inefficient...

** those NOT FEARING to be WRONG...

** LACK CRITICAL ATTITUDE OF SELF|IDEAS|and ABILITIES

** RESOURCEFUL

** NON-CONFORMING to the Traditional

Everybody is born an inventor. As children we invent games until grown ups persuade us that our inventing is futile,that we should conform with yesterdays seemingly proven but unusually outworn invention. But inventiveness remains latent in ALL OF US

BUCKMINISTER FULLER
I SEEM TO BE A VERB

WILLINGNESS TO TAKE THE RISK...

The independant inventor is often without backing of research institutions and lack in funding. This does not stop the QUEST for new INVENTION™ Here is a partial list of inventions of the 20th century and those who were WILLING TO TAKE THE RISK™

** GILLETTE...the inventor of the safety razor was a travelling salesman in crown corks.
** KODACHROME...the joint inventors were musicians.
** EASTMAN...when he revolutionized photography was a bookkeeper.
** CARLSON...the inventor of xerography was a patent lawyer.
** ZEPELL...the inventor of the ball point pen was at various times a sculptor, painter and journalist.
** J™B™DUNLOP...one inventor of the pneumatic tire,was a veterinary surgeon.
** ...all the varieties of successful automatic guns have come from individual inventors who were civilians
** ...two Swedish technical students were responsible for the invention of domestic gas refrigeration.
** ...a 20 year old Harvard student for success in producing the first practical light-polarizing material.
** ...the viscose rayon industry was largely the result of the work of a consulting chemist,a former glass blower and a former bank clerk.
** ...an American newspaper person is credited with being the father of the parking meter.

excerpt from...pp198
-REAL TIME1
BROCKMAN & ROSENFELD
Anchor/Doubleday,1973

** ISEMAN...revolutionized the Roller Skate with the Micro-Star 2500,was a salesman.

WHY NURTURE INVENTIVENESS???

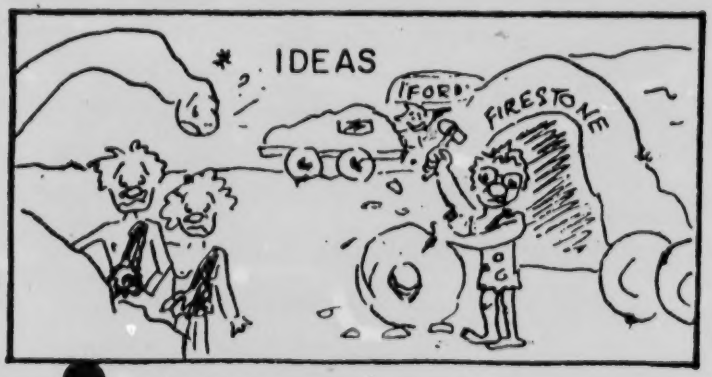
Because we are MOVING OUT OF THE INDUSTRIAL ERA and INTO the so called POST-INDUSTRIAL, it is inherent that we develop the skills and techniques necessary to handle the UN-PREDICTABLE CHALLENGES. The rise of automation and mechanization has resulted in more leisure time. The individual is not confined to the same needs and demands of yesteryear. Since the FUTURE is yet to be DISCOVED it is NOT PREDICTABLE. INVENTION IS A PREDICTION OF WHAT MIGHT BE. It is a function of the human brain which is not programmable. We carry the RESPONSE-ABILITY OF NURTURING INVENTIVENESS within our Selves and others.

It was once believed that the ability to invent was an innate ability of the genius. It is now known that inventiveness can be deliberately nurtured. Many techniques can be utilized to BREAK our HABITUAL THINKING patterns.

we must do all we can to encourage those capabilities which lend themselves to...

...EFFICIENT UTILIZATION OF OUR INVENTIVE ENERGIES...

-30-



WHY CREATIVITY IN EDUCATION???

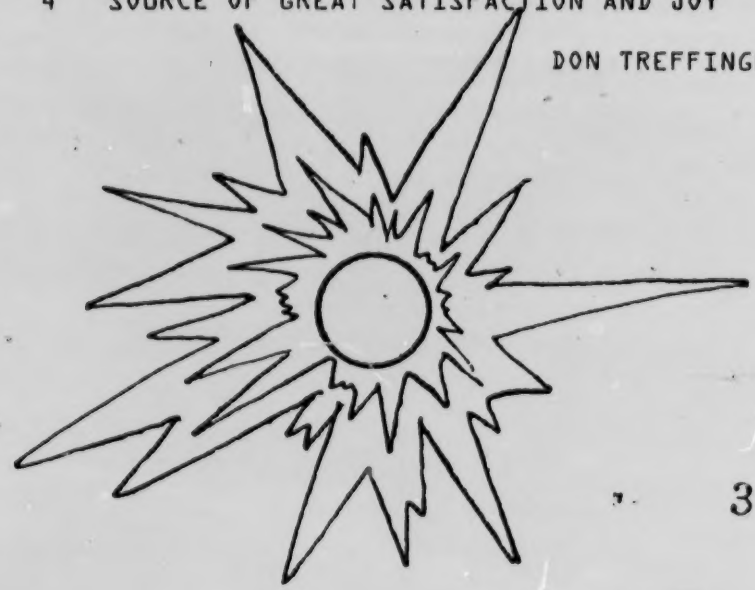
1. HELPS STUDENTS TO BECOME MORE EFFECTIVE WITHOUT DEPENDANCE ON ADULTS

2. HELPS STUDENTS SOLVE PROBLEMS WE MAY NOT EVEN BE ABLE TO ANTICIPATE

3. CAN LEAD TO POWERFUL CONSEQUENCES IN OUR LIVES

4. SOURCE OF GREAT SATISFACTION AND JOY

DON TREFFINGER



INVENTIVENESS CAN BE DEVELOPED

POTENTIAL ENERGY is of no earthly good to anyone unless it is SET INTO MOTION FOR SOME USEFUL PURPOSE. Once this energy is allowed to flow again and by giving it some form of discipline, it can become effective whenever and wherever applied. INVENTION is a simple matter of MAKING new and practical CONNECTIONS AMONG PRE-EXISTING IDEAS. It is possible for any individual to discover these new connections.

It is our duty as educators to bring these abilities to the surface for those who NEED| DESIRE|DEMAND| AND WANT new invention and discovery.

By UNLOCKING ourIMAGINATIONS we can then begin to EXPERIENCE the vast POTENTIAL AVAILABLE to us, and devise means of EFFICIENT PREPARATION FOR THE FUTURE. As a Democratic society our concern for the DEVELOPMENT of the INDIVIDUAL isGREAT. Our advancement as a Race on the Earth depends greatly upon the developement of these vast capabilities. DISCOVERY AND INVENTION ARE MEANS FOR GROWTH AND CHANGE.

EFFECTIVENESS is DETERMINED BY HOW these TOOLS AND TECHNIQUES ARE USED .... ANY INPUT NEEDS TO BE EXPERIENCED FOR GOOD TO BE REAPED FROM IT....

HERE IS A PARTIAL LIST OF SOME AVAILABLE TECHNIQUES WHICH MIGHT BE UTILIZED TO NURTURE INVENTIVENESS WITHIN .....

....ATTRIBUTE LISTING

....BIONICS

....BRAINSTORMING

....CHECKLISTS

....CREATIVE DRAMATICS

....CREATIVE PROBLEM SOLVING

....FORCED RELATIONSHIPS

....GENERAL SEMANTICS

....IMAGINATION GAMES

....KEPNER-TREGOE

....MORPHOLOGICAL ANALYSIS

....PEER TEACHING

....DIRECT-DISCOVERY

....SYNECTICS

....FUNCTIONAL VISUALIZATION

ON ENGINEERING AND CREATIVE PROBLEM SOLVING

"Engineering as a Realm of Human Activity is concerned with the transformation of things natural into things artificial." (1) It centers on the application of mans intellect in the service of mankinds physical and social needs via theories acquired in Science.

"Creative Problem Solving (CPS) is a process for approaching a problem in an imaginative way resulting in effective action." (2) It helps to break up habitual thinking patterns in order to design new and unique combinations of ideas and action.

The interaction of these two realms, Engineering and Creative Problem Solving results in a disciplined approach to the innovative process. (ie. that path where the invention and discovery are developed) The underlying processes of both Engineering and Creative Problem Solving allow for their individual existance as independant entities. Their inter-relationship creates new and unusual invention. Invention can then be focused toward any particular need, want, desire and/or demand and result in effective action.

Creative Engineering is sorely needed among all levels of education. Now that there are available skills and techniques to enhance and nurture creative, inventive abilities of the human personality, there appears to be no better time than now to apply them in Education. It will be in the direct application of Creative Problem Solving abilities to the study of Engineering abilities that we might best grow and change for the Future to be...

1. statement by Stanley Kasprzyk-SUCB

2. Noller, Ruth, 1977, p.5

INVENTION / DISCOVERY

AN ANTHOLOGY OF ACTIVITY

BY ANN MARIE HINTERBERGER

PURPOSE

It is the intention of this booklet to provide a springboard of activities which can be used in conjunction with existing curriculum in order to provide a variety of techniques to stimulate and encourage creative, inventive qualities in both the student and educator.

A number of the pages have been designed for transparency duplication. It is my hope that they will serve as useful tools in the ever-present quest of future orientated curriculum.

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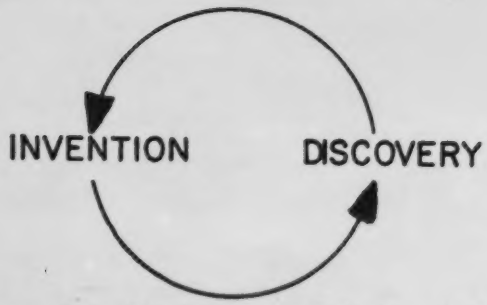
WILLINGNESS TO TAKE THE RISK...



"Einstein broke with Euclidean metaphors in order to conceive his relativity theory. Picasso broke with the old metaphors of perception. Creative Innovation leads to new art and science or to individual,psychological insights...needed in the learning process."

Gordon

The learning process consists of the ability to make necessary connections and associations between that which is familiar and that which is not yet familiar. As Human Beings we are able to consciously discover and invent, we do this by making and breaking these connections in order to increase our understanding of the world around us.

The use of analogy is quite familiar to the field of Industrial Arts Education. It is an old friend of the Enginneer and Inventor who through the use of Metaphor and Analogy are able to see new and unique functions and applications in new combinations of pre-existing and newly discovered ideas. Because of the infinite number of idea combinations available to us, anything becomes possible. We must be prepared for the unexpected and this entails excercising all the possibilities...

It is sometimes easier to understand some thing if we place our Selves in the position of the thing...Have the students (Educators too!! it would be a shame to miss all the fun) BE THE THING THAT IS BEING EXPLORED!! The following lesson plan incorporates this concept ...

A lesson plan in machine motion

.....role playing

Introduction: This plan was used with 7th and 8th graders. After a lively discussion about their observations, the students were able to role play machine motions. This experience has helped them to remember the different machines more easily.

Purpose: To demonstrate the various machine concepts of motion, found in the Industrial Arts laboratory.

Objectives:

1. Students will demonstrate the various motions seen in observing laboratory machines.
2. Each student will name at least two machines in the lab and tell how they differ from one another.
3. Students will explain how knowledge of machine functions might better help them to work more efficiently and skillfully.
4. Students will explain how thelack of one machine might be overcome by the use of another machine.
5. Students will work efficiently as a group.
6. Students will name three principle motions common to all machines.

Content:

1. Machines are an extension of our own energy. They enable us to perform work in a more efficient manner.

Technique:

1. Before activity begins, select a series of machines in the lab which BEST display the basic motions of the machines.
2. The names of these machines are placed on separate pieces of paper and placed in a container.
3. Have the students observe all of these machines and to notice the different motions they see as you turn machines on and off.
4. Divide students into smaller groups of 5 or 6.
5. One member from each group selects a paper from the container.

Content: (continued)

After Activity

2. Every machine performs one or more of these motions:
   a. circular
   b. up and down
   c. back and forth

3. Some machines perform the same function by different motions. (ie. router and circular saw).

4. Some machines perform similar functions with different purposes (ie. drill and jig saw).

Technique: (continued)

6. Groups are given 5 minutes to figure out how they will represent a selected machine, with their bodies.
   ALL MUST PARTICIPATE.

7. One at a time, each group demonstrates what machine they represent.

8. Ask students what the differences were between any two of the machines (ask for another two).

9. Ask students what three motions they saw on the machines.

10. Write these answers on the board.

11. Point out two machines which perform the same motion for a different function (ie. router and circular saw).

12. Ask students to point out two machines which might do the same function.

13. Lead students into discussion :
    - Knowing the different machine motions help us to work more efficiently and skillfully.

Daniel Walter Paul
Ann Marie Hirtzberger

ACTIVITY ...

* Gather participants into groups of approximately four or five.
* Each group has an object in front of them (be it strange or familiar) toys are excellent discovery material...
* The participants are then asked to explore this object and become familiar with it
* The Leader then brings participants into a calm, relaxed atmosphere in which they will be lead into an imaginary situation

* RELAXATION is a key element in the development of our imaginative ability. Some helpful hints are as follows...
  * close the eyes (this cuts off the outside visual stimulation allowing for better concentration)
  * allow a few moments for some slow even breaths
  * set the scene

* SITUATION...

You are a visitor of Earth from the planet Krayon...The planet Krayon is a highly sophisicated and technological society. There is not much you do not understand... You have landed on earth and the first thing you and your group have encountered is this (whatever the object is...) -------....Explore this THING and in what ever language you are best able to speak in discuss the possible applications for this newly found THING.

LIST_____

_____

_____

_____

_____

_____

_____

*Bringing this into the REAL WORLD ,what new connections where made on this object?? In what ways might this object find new and unique purpose (either as a whole or any combination of its parts??? This is given as an example of how the use of Analogy and Fantasy can be used to unlock the doors to our imaginative inquisitive minds...in order to encourage the INVENTOR WITHIN..

JUST IMAGINE...

You are a world famous inventor. You have approximately 10,000 patents on the market,your favorites include the wheel,the lever,and the scissors. The world is waiting for this day because you are about to reveal where some of your ideas came from...

What analogy did you use while inventing the scissors? describe how this enabled you to cut better.

What animal did you see which gave you the inspiration for fly paper?

What did you see in the natural world that helped you to invent the paper cup?

We understand that you obtained many ideas from the elephant. list some of the many invention ideas you got from this animal...

***The list is inexhaustable...
Think of some other questions you might want to ask...

A Lesson in Group Brainstorming

Purpose: To give students practical experience at brainstorming and deferred judgement, as used in a classroom situation.

Objectives:

1. Students should use the basic points for brainstorming.
2. Each student will explain what is meant by "deferred judgement" (withholding judgement).
3. Students will express their thoughts, honestly and openly, in the classroom.
4. Each student participates in a common goal with the group.
5. Students demonstrate courtesy and respect for each other in the classroom.
6. Each student will define the term "brainstorming", as it has been used in the classroom.

Content:

1. Defirition :

   "Brainstorming" is a method of generating a quantity of ideas in a variety of areas by withholding (deferring) judgement.

2. How to Brainstorm:

   a. Basic steps
   (1) RELAX
   (2) Let ideas flow, esp. if crazy or silly.
   (3) Think of many ideas; quantity is needed.
   (4) Give "far out" responses.
   (5) Give ideas which are new & ideas which might have been said before or changed.
   (6) S C A M P E R
   (7) All ideas are good; do not judge ideas at this point (deferred judgement).

3. Why Brainstorm?

   To increase the scope of possible answers to a problem.

   To obtain new & original ideas.

Techniques:

1. Write: "BRAINSTORMING" on a chalk board with the def.

2. Volunteers are needed.
   (a) Select a Timekeeper.
   (b) Select a Writer.
   (c) Review Steps for Brainstorming (may be written on board).
   (d) Tell students to try to get at least 30 ideas (but don't count these ideas!)

   OR

   (e) Fill up a square drawn on the board.

   (f) Do the Brainstorming Activity.

3. Use analogies.
   (a) E.g. -Many drops of water (B-rainstorm) could be funneled into one bucket for a greater amount.
   (b) Ask Students how this relates to many people working toward one goal.

BRAINSTORM LESSON: POINTS TO KEEP IN MIND
(for teacher use only)

1. The common goal of Group Brainstorming is total participation of audience (including the teacher!)

2. The General Atmosphere should be free and open.

3. Students should demonstrate respect for others Ideas
NO IDEA IS SILLY OR USELESS!!!!

4. Encourage ORIGINALITY.

5. At ALL times judgement should be withheld (deferred).

6. The use of ANALOGIES is highly effective in promoting an understanding for why Brainstorming is useful.
(ie. having many items to choose from in a store--or in the stock room--increases the possibility that a quality choice might be made)

7. In order to broaden the students perspective--You might interject probing questions such as; What if this were made longer? smaller? a different shape? etc....

8. The topics selected to brainstorm on should be of a COMMON KNOWLEDGE to ALL the students ie. pencil,pen,light bulb, table, chair...

9. Pictures help to break any problems with understanding the terms used.

10. QUANTITY BREEDS QUALITY!!!

11. Encourage students to Hitch-Hike (take off from other ideas) to form new ideas.

12. Challenge the students to flow with the ideas... do not let the writer's hand leave the black board (or what ever is used)

13. This phrase may help both you and the students to free more Ideas... Substitute
Combine
Adapt
Modify
inify
agnify
Put to other uses
Eliminate
Rearrange

BRAIN STORMING
RULES

1 DEFER JUDGEMENT

2 FREE WHEEL

3 HITCH HIKE

4 QUANTITY BREEDS QUALITY

S ubstitute

C ombine

A dapt

M odify
agnify - inify

P ut to other uses

E liminate

R earrange
edesign

SCAMPER

This is a form of a Check-List which can be used quite effectivily in the classroom situation. A brief discription of how I was able to implement it is as follows...

The SCAMPER words were decribed as to their meaning and importance in our every lives...This occured throughout the unit as reinforcement along with small stretching excercises and puzzles...The words are significant in that they then become aids in assisting the imagination as well as the acquired knowledge that each individual child possesses to create, discover,or invent something new and unique...

This is merely a tool for further encouragement of inventiveness. The structure and discipline as well as the content of the lesson are dependant upon the educators wants,needs,desires and demands...

In my application of SCAMPER the students were asked to use these words in order to make or invent something out of several pieces which they were to find among a table full of old project pieces, abandoned projects from years past.,and scrap pieces of material found in the lab as well as thier own homes.

This was done in a city school, and the results were astounding...I was able to give individualized instruction to those students needing information on proper tool usage. Each student pursued their own line of interest. It was done with 7th and 8th graders,and the variety and mutivation which was generated was fantastic...(and the display on Parent's Night was quite colorful and impressive!!!)

It's application IS AS VAST as the imagination of its applicator...Put it to other uses...Substitute the words... Redesign its structure...Adapt it to lessons now being presented...Combine it with other methods and techniques of problem solving... The possibilities are endless...

HOW TO USE MATRIX...

1 CHOOSE AN ITEM

2 PICK THREE ATTRIBUTE SQUARES

3 CHOOSE ONE OF TWO ALTERNATIVES

4 SELECT 1,2 or 3 MATERIALS TO WORK IN

5 DEVELOP OBJECT IN IMAGINATION

6 MAKE SKETCH

7 DEVELOP PLAN OF ACTION

MATRIX

ITEM / ATTRIBUTE					

THE POSSIBILITIES ARE UNLIMITED...

DESIGN ONE SOLID OBJECT

SPECULATIONS: MUST FILL ENTIRE CAVITY

MUST PASS COMPLETELY THROUGH EACH

LEARNING ACTIVITIES:

The ultimate success of any program centers in the quality of the instruction that takes place. Central to this success is the quality of the teaching and learning activities that are used in meeting stated objectives.

Industrial education programs have always focused on the laboratory approach of "learning by doing." The ideas for teachers and the learning activities for students that are included in this handbook were selected as exemplary learning experiences.

Industrial education programs should be exciting, relevant and action oriented. Well designed activities, selected from a variety of sources, that motivate students are included as suggestions for improving instruction.

LEARNING ACTIVITIES

The following learning activities have been developed to assist in fulfilling the objectives of The Wisconsin Guide to Local Curriculum Improvement in Industrial Education, K-12*and each activity is coded to these objectives. The objectives are included and numbered on the following pages. The numbers in parentheses indicate the objective(s) to which each activity relates.

*Source: The Wisconsin Guide to Local Curriculum Improvement in Industrial Education, K-12 Wisconsin Department of Public Instruction Barbara Thompson/State Superintendent

1. To provide students the opportunity to work with elements of industry to gain an understanding of how they function in providing goods and services.

System Elements	Plan	Execute	Evaluate
Research and Development-investigation and experimentation conducted for the purpose of arriving at a solution to an identifiable need	*establishing a systematic plan to accomplish an end *identifying societal wants for goods and services *solving problems of industry, technology and society	*designing goods and services *developing plans by experimentation, models and surveys	*choosing solutions for implementation and developing evaluative criteria to determine if goods and services satisfied societal desires

2. To provide students the opportunity to explore the context in which industry has developed and continues to develop.

System Elements	Past	Present	Future
Research and Development-investigation and experimentation conducted for the purpose of arriving at a solution to an identifiable need	*discovering by accident; by trial and error, from a small research base, by individuals with limited technology capability	*discovering by coordinated research efforts, experimentation, with an extensive research base, and sophisticated technological capability	*expanding research base instant information retrieval, highly specialized personnel and extensive technological capability

3. To provide students the opportunity to explore industrial occupational areas as a basis for selecting a career and understanding the pursuits of others.

System Elements	Self-Awareness Here I am--I Can do things:	Career Awareness There are jobs to be done:	Career Exploration I would like to assess my interests by
Research and Development-investigation and experimentation conducted for the purpose of arriving at the solution to an identifiable need	*defining problems, collecting information, analyzing data, and proposing and evaluating solutions	*associated with the research and development in industry	*experiencing some activities of people that work in research and development

4. To provide students the opportunity to prepare specifically for entry into appropriate industrially related occupations and develop a base for further occupational education.

System Elements	Technical Competencies	Human Relationships
Research and Development-investigation and experimentation conducted for the purpose of arriving at the solution to an identifiable need	*analytical thinking, technical understanding, and research knowledge: defining, collecting, analyzing, proposing and evaluating	*relate to individuals and groups at various levels within the industry and with the general public

Objective

To provide students the opportunity to understand the interdependence of society and industry.

The structured body of content of this objective identifies the areas where society and industry interact and have reciprocal effects. Here, the dynamics are such that it is not possible to categorize social situations to correspond with any single element of industry. Society has many elements as does industry. The role of industrial education is not to analyze society, but to provide for a study of industry as an institution of society. Industry, therefore, must be studied as it corresponds to dynamic societal situations.

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5. To provide students the opportunity to understand the interdependence of society and industry.

System Elements	Dynamic Societal Situations
Research and Development--Investigation and experimentation conducted for the purpose of arriving at a solution to an identifiable need	*Supply and demand*--industrial production is determined by societal demands for goods and services.
Production--the methods and processes used in the output of goods and services	*Industrial assets*--industries provide assets to the communities in which they are located; communities become dependent upon these assets from industry.
Marketing and Distribution--flow of goods and services from producers to consumers	*Location of industry*--industries are attracted to and are dependent upon areas in which there are human resources; people are attracted to areas in which industry exists.
Maintenance and Services--servicing property, equipment and people	*Human resources*--industry depends upon human resources to accomplish its goals and man depends on industry to fulfill his needs.
Resource Elements	*Financial dependencies*--man as a member of society is dependent upon industry for his financial support; industry is dependent upon society for its financial support.
Finance--acquisition and utilization of financial resources in industry	*Environment and industry*--industry operates to meet the needs of man and creates an environmental imbalance that is subject to limitations imposed by society.
Manpower--human resources essential to industry	*Profit factor*--the satisfaction of industry's motivation is partially dependent both upon man as a resource and as a consumer.
Power and Energy--the fundamental ingredient in all mechanization and technological development which may be transformed into work	
Coordinating Elements	
Management--operational activities which provide for the leadership of an enterprise	
Communications--interaction resulting in the exchange of ideas and information	

1. To provide students the opportunity to work with elements of industry to gain an understanding of how they function in providing goods and services.

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2. To provide students the opportunity to explore the context in which industry has developed and continues to develop.

System Elements	Past	Present	Future
Research and Development-investigation and experimentation conducted for the purpose of arriving at a solution to an identifiable need	*discovering by accident; by trial and error, from a small research base, by individuals, with limited technology capability	*discovering by coordinated research efforts, experimentation, with an extensive research base, and sophisticated technological capability	*expanding research base, instant information retrieval, highly specialized personnel and extensive technological capability

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GRAPHIC COMMUNICATIONS

Learning Activities

Objective

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The structured body of content of this objective identifies the areas where society and industry interact and have reciprocal effects. Here, the dynamics are such that it is not possible to categorize social situations to correspond with any single element of industry. Society has many elements as does industry. The role of industrial education is not to analyze society, but to provide for a study of industry as an institution of society. Industry, therefore, must be studied as it corresponds to dynamic societal situations.

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Power and Energy--the fundamental ingredient in all mechanization and technological development which may be transformed into work	
Coordinating Elements	
Management--operational activities which provide for the leadership of an enterprise	
Communications--interaction resulting in the exchange of ideas and information	

TITLE Remote Writing

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (2, 1)

Introduction

Man has always made an effort to doing things in the easiest way. As students, you are going to have this opportunity. You will sit 10 feet from the chalkboard and you will be required to write material on it. You want to be able to write on the chalkboard without leaving your seat.

Problem Statement

Devise a method that will enable you to write on the chalkboard from 10 feet away.

Design Criteria

1. You cannot leave your seat.
2. Size of print must be from 2-4" in height.
3. Writing or printing is permitted.

Evaluation Criteria

1. Neatness of writing.
2. Consistency of writing.

TITLE Sound Transmission

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 2, 4)

Introduction

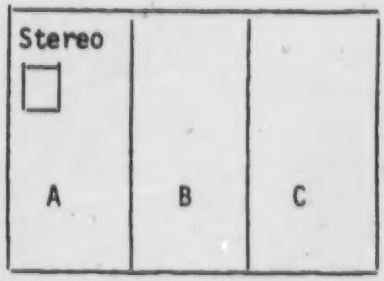
Three classrooms are adjacent to each other. There is a stereo in one end room. It is desired to have music in the classroom in the other end classroom without hearing it in the center room.

Problem Statement

Devise a means of transmitting sound from classroom A to C without disturbing room B.

Design Criteria

1. No windows or doors connecting rooms.
2. Walls are concrete block.
3. Any material may be used.
4. Rooms measure 20' x 25'.



Evaluation Criteria

1. Trueness of sound reproduction.
2. Minimize loss of power.

TITLE Growing Food

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 5, 2, 4)

Introduction

In trying to cope with inflation, many families wish to grow their own food. For many, though, space available is a problem.

Problem Statement

Develop a method of growing vegetables for a family of four in 200 square foot area.

Design Criteria

1. Vegetables; peas, corn, potatoes, tomatoes, carrots, and cabbage.
2. Growing needs for various vegetables.

Evaluation Criteria

Quantity of vegetables

TITLE Play Area

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (2, 5)

Introduction

Having small children playing in the yard in a certain area is a problem for most parents.

Problem Statement

Determine a method of confining a small child to a 25 square foot play area without using a fence or wall of any kind.

Design Criteria

1. Safety of child
2. Cost of system
3. Should be portable

Evaluation Criteria

1. Safety
2. Cost
3. Effectiveness

TITLE Container for Liquid Materials

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 2)

Introduction

There is a great variety and quantity of commercially-produced liquids that must be stored and dispensed.

Problem Statement

Design a device to store and dispense liquids like paint or varnish.

Design Criteria

1. Amount of material to be handled.
2. Method of identification.
3. Sealing
4. Shipping and handling.

Evaluation Criteria

1. Cost
2. Durability
3. Efficiency

MATERIALS AND PROCESSES

Learning Activities

TITLE Plastics Identification

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 4)

Introduction

There are many plastics on the market today and identification can be performed quite easily using proper techniques. Many uses for empty containers and wastes can be found. This activity will have you collect data on these potentially useful waste products.

Problem Statement

Collect data about different plastic products using a number of tests to identify how the product is made and also to determine the type of plastic.

Design Criteria

Given a number of plastic products, identify each material and categorize each.

Tests developed to arrive at classification.

Evaluation Criteria

List developed; testing procedures.

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (4)

Introduction

The student will design, build and operate a hydraulic front end loader that can be installed on a garden tractor. The student will be given the option of building the loader for his own use, for a friend who might furnish the materials, or for the instructor who will find someone to provide the materials.

Problem Statement

Design and build a front end loader for a garden tractor.

Design Criteria

Size related to garden tractor and materials as to amount of money he can spend.

Evaluation Criteria

1. Research conducted.
2. Blueprints.
3. Appearance of finished product.
4. Operation of the unit by teacher and student.

TITLE Paper Platform

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 2)

Introduction

Paper can be used as a strong and lightweight construction material with minimum investment. You will have the opportunity to fabricate paper into a form capable of supporting as much weight as possible.

Problem Statement

Design and construct a platform using paper that will support your own weight.

Design Criteria

1. Use only 1 sheet of paper, 8½" x 11" and 2 sheets, 5" x 8".
2. Finished dimensions should be 5" x 8" x ½".
3. White glue is the only fastener allowed.
4. A piece of wood will be placed over the platform before load is applied.

Evaluation Criteria

Amount of weight platform can support.

TITLE Hot Dog Cooker

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (2)

Introduction

You will be going on a camping trip in the woods and will be eating hot dogs. They must be cooked, buy you can't have any open flame or electricity. You will be camping in a clearing near a stream.

Problem Statement

Design and construct a device capable of cooking a hot dog.

Design Criteria

1. The device can't use -
   a. flame
   b. electricity
2. You must be able to carry it on your back.
3. It must weigh less than five pounds.
4. Hot dogs must be hot.

Evaluation Criteria

1. Speed at which hot dog is cooked.
2. Minimal cost.

TITLE Lost in the Woods

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (2)

Introduction

You have found yourself lost in the woods. Wooden stakes need to be driven in the ground to support a roof for your shelter.

Problem Statement

Devise a tool capable of driving stakes in the ground using materials at hand.

Design Criteria

1. The instructor will furnish the following:
   a. Sticks
   b. Rocks - stones
   c. Vines
   d. Wooden stakes to be driven (about 1" in diameter)

Evaluation Criteria

1. Durability of device
2. Effectiveness
3. Creative use of materials

TITLE Manufacturing Jig

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,4)

Introduction

The manufacturing class has developed a toy car made of wood as its project. The problem encountered is to drill holes in the center of the wheels on a mass production basis.

Problem Statement

Develop a jig capable of drilling holes in the center of wooden wheels.

Design Criteria

1. Wheels are 2" in diameter
2. Wheels are ½" thick
3. Hole must be ⅛" diameter
4. Tolerance -

Evaluation Criteria

1. Accuracy of hole
2. Speed at which holes can be drilled

TITLE Automatic Watering Device

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (2, 5)

Introduction

House plants all need water at varying times and in varying quantity. Their health is dependent on watering them properly.

Problem Statement

Develop a method to automatically water house plants.

Design Criteria

1. Proper amount of water for each type of plant.
2. Water dispensed at the proper time.
3. Source of water.

Evaluation Criteria

1. Efficiency
2. Appearance
3. Health of plants

TITLE Plastic Recycling

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,5)

Introduction

Billions of pounds of plastic products are produced annually. Of these, many are of the throw away nature and are wasted.

Problem Statement

Develop a method of recycling commercially-made thermoplastic products.

Design Criteria

1. Characteristics of thermoplastics.
2. Quantity of material available.
3. Method of identifying and separating types of plastics.

Evaluation Criteria

Practicality of idea

TITLE Packaging of Delicate Materials

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,3,5)

Introduction

Many delicate items must be packaged, handled and shipped all over the world safely, inexpensively and efficiently.

Problem Statement

Design a package that will prevent the breakage of a raw egg.

Design Criteria

1. Package and egg must withstand a fall of ten feet on concrete.
2. Weight and cost of package cannot be more than the egg.

Evaluation Criteria

1. Cost of package
2. Weight of package
3. Success

TITLE Injection Molding

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,3,4)

Introduction

A plastic injection press can be used to form a variety of products.

Problem Statement

Design a product to be made by a 3 oz. injection press.

Design Criteria

1. Mold requirements
2. Size limitations
3. Material colors
4. Process operation

Evaluation Criteria

1. Usefulness
2. Accuracy
3. Appearance

TITLE Adhesives

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 2, 5)

Introduction

Modern society offers a multitude of adhesive products.

Problem Statement

Determine the best adhesive to use for fastening common materials.

Design Criteria

1. Cost
2. Available types
3. Efficiency
4. Common materials

Evaluation Criteria

Validity of results

TITLE Materials Properties

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 2)

Introduction

Industry produces millions of products made from different materials. The materials used for various products are carefully chosen.

Problem Statement

Choose 25 different commercially-made products and determine why the primary material used was chosen.

Design Criteria

1. Characteristics of various materials

Evaluation Criteria

1. Reasons for that material being chosen

TITLE Wood Structure

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,4)

Introduction

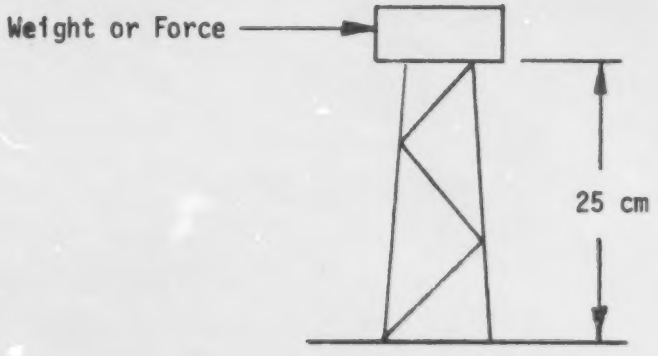
We have studied the theory of compression and tension and how it relates to construction. You will now put this theory to use.

Problem Statement

Using 5mm square wood stock and white glue, (supplied by teacher), design and construct a structure that will hold as much weight as possible 25 cm above a flat surface.

Design Criteria

The longest continuous piece of wood that can be used in the structure may not exceed 25 cm. The student is limited to 5 linear meters of 5mm square stock. Vertical members may not be laminated together to form thicker structural members.



Evaluation Criteria

Structure meeting design criteria; structure that holds the most weight.

INDUSTRIAL MANAGEMENT

Learning Activities

84

RESEARCH & DEVELOPMENT
LEARNING ACTIVITY (1)

TITLE Shop Planning

INTRODUCTION

Factory equipment and facility layouts are very important to production efficiency. In order to become familiar with considerations dealt with in this phase of industry, you must solve a problem.

PROBLEM STATEMENT

Draw a floor plan of your home. Show placement of furniture and direction of the building positioned on the land. What changes would you make in this layout? Re-draw the plan to show all changes.

DESIGN CRITERIA

1. Consider direction building faces
2. Consider access patterns
3. Consider traffic patterns
4. Consider placement of furniture
5. Consider positioning of rooms

EVALUATION CRITERIA

Based upon individual justification for plan. There is no single solution.

TITLE Purchasing Quantity Items

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 3)

Introduction

Some industries spend over 25 million dollars a day making purchases. With a quantity order, a mistake in size, quality or whatever could result in an overwhelming number of problems. It is expected that this strategy should result in strengthening the act of choosing among alternatives and affirming the choice made.

How adequately could you handle the purchasing for a large company?

Problem Statement

Trying to cut purchasing costs, what do you do first, second, third, fourth:

--buy low quality with cheap price
--buy inferior quality thus tainting the reputation of your company
--buy quantity which results in stockpiling and preventing innovative changes
--buy good quality which will lead to overspending and perhaps costing you your job

Design Criteria

Individually rank you choice. Divide into groups to arrive at a concensus. Have entire class work to arrive at a concensus. Have spokespersons for each group. Only they can talk and discuss while group members may only write messages to their group leader. The leader may be replaced if not doing a good job.

Evaluation Criteria

Keep track of process each group uses to reacn concensus. Perhaps reward group for a novel solution.

SOURCE: John P. Nosgel, "Development of Values Clarification Strategies for the Enterprise System", (unpublished paper, University of Wisconsin-Stout, August 1976), p. 39.

TITLE Authority in Industry

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (4)

Introduction

A boss often times is looked upon with distaste because he is expected not to allow anything that is not in the best interests of the school; i.e., spoiling fun. Most often, a boss is considered inhuman; in some cases, tyrants. This exercise focuses on what a boss should be and what qualities the person in authority should maintain.

Problem Statement

Develop a list of qualities a boss should possess.

Design Criteria

List of qualities developed by each student. Divide students into two or more groups to discuss and refine the list. Organize the group list and rank them as to importance by group concensus.

Evaluation Criteria

Size of list developed.
Process of developing list.
Process of Concensus.

SOURCE: Development of Values Clarification, p. 37.

TITLE Personal Relations

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 4)

Introduction

In industry, confronting your subordinates about a problem is a difficult task. Much skill and diplomacy is necessary in management. Frequently, an on-the-spot decision is made with the hope that it is the wisest choice. Managing people is a very difficult job. If employees are not happy or satisfied, poor quality work results along with absenteeism, delays in production, and personnel conflicts.

Problem Statement

Since you are a part of management, it is your job to insure that everything is proceeding smoothly with the people under you. How would you handle an employee who is:

1. always late
2. drunk several times a week
3. wastes a lot of time
4. careless about his work
5. causing trouble among workers
6. stealing from the company

Design Criteria

For each item, a student should give Alternative #1, #2, #3. Place item on board and write in some selected alternatives. Discuss alternatives with class.

Evaluation Criteria

Thought content of individual alternatives. Participation in class discussion.

FROM: Development of Values Clarification, p. 35.

TITLE Ethical Dilemma

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1)

Introduction

There are many situations in our society which cause conflict between our ethical background and the job. A decision must be based on alternatives in each situation to arrive at the best solution. What would your reaction be to the following circumstances? Rank your choices from that which you consider to be most effective to that which, in your situation, would be least effective. Be prepared to defend yourself.

Problem Statement

More research is needed to:

- control the population
- provide for leisure and entertainment
- deal with pollution and environment

Design Criteria

Divide class into two or more groups. Each group will develop a list of supportive statements to each of the above. Each group will arrive at a concensus of opinion as to what the group decision will be.

Evaluation Criteria

Size of list from each group and the method of reaching concensus.

FROM: The Development of Values Clarification, Strategies for the Enterprise System by John P. Norgel, August 1976, Graduate College, University of Wisconsin-Stout, p. 33.

TITLE Research Products

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 2)

Introduction

All of our lives we are consumers of industrial products. There are many things to consider when making a purchase. For the manufacturer, making money is the name of the game; that's what your business is all about. Before you select a product to manufacture, you have to be sure it will sell, expenses are within reason, and that the product or service developed will fill a need.

Problem Statement

How many of you:

1. feel that research for defense should be continued at the present rate? or be reduced? or be discontinued?
2. when buying a shirt or blouse, dress or slacks, are influenced by friends? by magazines and newspapers? by television? by sales person?
3. when helping parents grocery shop, compare prices? compare ingredients or materials? buy brand names? look for attractive labels? are not concerned?
4. can identify differences in quality of items?
5. are concerned about whether or not a product can be fixed or repaired when purchasing? look or ask about a guarantee or warranty?

Design Criteria

Instructor will read questions and students will vote using a procedure such as:

1. agreement - raising one's hand
2. disagreement - thumbs down
3. undecided - arms folded
4. passing, no comment - no action

Tally response on board and use for later discussion.

Evaluation Criteria

Participation and cooperation.

FROM: Development of Values Clarification, p. 32.

TITLE Problem Solving

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,3,4,5)

Introduction

All through our daily lives, we are faced with solving problems. How well we are able to deal with them greatly affects our daily lives.

Problem Statement

Develop a method to be used for solving problems.

Design Criteria

1. Applicable to many types of problems.
2. Simple enough to be used easily.

Evaluation Criteria

1. Effectiveness of solution
2. Efficiency of solution

TITLE Advertising

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 3)

Introduction

Industry has many new products to sell each year. Most are promoted by various advertising media.

Problem Statement

You are responsible for promoting a motorized skate board. Which advertising media would be best?

Design Criteria

1. Who will be sold to
2. How to make appealing
3. What media is available

Evaluation Criteria

1. Quantity of people reached
2. Cost of advertising

TITLE Equipment Utilization

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,3)

Introduction

In introducing equipment to students in a lab class, a problem is encountered in having students use all the machines.

Problem Statement

Design a product costing less than $5 and that requires the use of every machine in the shop.

Design Criteria

1. What various equipment can do
2. How much material can $5 buy

Evaluation Criteria

1. Does it use all machines
2. Useable product

ENERGY AND TRANSPORTATION

Learning Activities

TITLE Rocket Production

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 4)

Introduction

In industry today, there are constant pressures placed on personnel to produce quality items in the shortest time. Companies offer large rewards to those departments and workers doing the fastest work. Product quality may suffer when speed is emphasized too heavily, and company profits may fall when the market for this product drops off. Both quality and quantity are needed for a company to make profits and stay competitive in business.

Problem Statement

To make X number of rockets in the shortest number of class periods while maintaining good quality in the product. Develop a system which will best meet these above requirements.

Design Criteria

Rockets must meet the requirements as laid out in the lab manual from "The World of Manufacturing Program".

Evaluation Criteria

--will be based on meeting requirements in lab manual
--the group that completes their rockets in the shortest number of class periods
--the group that designed the most efficient method or system to accomplish the goal

TITLE Electrically-Powered Dragster

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,4)

Introduction

The student will learn the principles and working theory of a direct current electric motor. A student wanting to get the most out of his motor will study principles of electric current on his own.

Problem Statement

Design and build a "dragster" using the electric motor for the power supply.

Design Criteria

Any design is acceptable. Engine modification is allowable. Drag strip of 30 feet in length; 27 volts is the power supply.

Evaluation Criteria

Ingenuity of design; modifications to engine; position in finals.

BY: Tom Golden

TITLE Tidal Power

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1, 2)

Introduction

You live along the coastline in Nova Scotia where the average tide exceeds 20 feet. People in your town have decided to harness energy from this tidal change. This must be accomplished without blocking the harbor's shipping traffic.

Problem Statement

Design a system and build a scale model which will permit the tidal energy to be converted into a useful form.

Design Criteria

1. The instructor would supply a basic map of the harbor showing size and location of key points.
2. The energy must supply the town of 20,000 people with half its required energy.

Evaluation Criteria

1. Estimated cost should be kept to a minimum.
2. Amount of energy produced.
3. Additional benefits gained from the project.

TITLE Methane Generator

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,5)

Introduction

A farmer has 200 cattle on his dairy farm. He desires to reduce his utility bill by utilizing the waste from his cattle.

Problem Statement

Design a system capable of converting evergy available in the waste from cattle into a form of energy the farmer can use.

Design Criteria

1. Waste comes from 200 cattle.
2. The farmer has 3 diesel tractors.
3. The barn is 40' x 150'.

Evaluation Criteria

1. What amount of energy will the system generate.
2. How much could the farmer save on utilities.

TITLE Paper Airplane

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,3)

Introduction

A need exists to transport notes across the room to your friend. Devise a means of moving these notes without the teacher noticing.

Problem Statement

Design and construct a glider capable of flying as far as possible.

Design Criteria

1. Only paper may be used.
2. Two sheets of 8½" x 11" paper is permitted.
3. Glue, tape and mechanical fasteners are allowable.
4. Time limit of one class period or more could be used.
5. Instructor-supplied launcher will be used.

Evaluation Criteria

1. Distance of flight.
2. Deviation from straight line.
3. Reliability of performance over a period of three flights.

TITLE Chimney Heat Loss

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (5,2,4)

Introduction

Wood-burning stoves lose large amounts of heat directly through chimneys. In order to maximize available heat, this heat loss must be reduced.

Problem Statement

Reduce the heat loss through the chimney of a wood-heating system.

Design Criteria

1. Device or design must be attached directly to wood-heating unit.
2. Chimney temperature must not be reduced to a temperature which results in unsafe creosote buildup.

Evaluation Criteria

1. Simplicity of device.
2. Minimal cost and use of material.
3. Safety.
4. Efficiency.

TITLE Coal Pipeline

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (5,2,1)

Introduction

The U.S. has an abundance of coal resources which must begin to replace diminishing fossil fuels. In order to minimize cost of transportation and conserve energy, a pipeline system must be developed to move coal.

Problem Statement

Develop a means of changing the form of coal into one which can be moved through a pipeline.

Design Criteria

1. Final form of coal may be liquid, gas or solid.
2. Process used must keep coal prices competitive with conventionally-transported coal.

Evaluation Criteria

1. Minimal cost of process.
2. Efficiency.

TITLE Solar Mover

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,3)

Introduction

A need exists to move objects as well as people with energy sources other than fossil fuels. The sun, as an inexhaustible and free source of energy, is an excellent alternative.

Problem Statement

Design and construct a device capable of moving a one-pound weight.

Design Criteria

1. Weight must be moved across land.
2. No source of energy other than the sun may be used.

Evaluation Criteria

1. Cost.
2. Distance of travel.
3. Dependability.

TITLE Firewood Efficiency

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (3)

Introduction

With the increased use of wood as a source of home heating, a need exists to determine the most efficient use of firewoods.

Problem Statement

Identify the types of firewood generally available in your local area. Determine which wood has the greatest BTU content per pound of material.

Design Criteria

1. Wood should be split.
2. Wood should be air dried for at least 6 months.

Evaluation Criteria

TITLE Solar Storage

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (2,3,5,1)

Introduction

A major problem with solar heating is storage of unused heat for periods without sunlight. A system or device is needed to store this excess heat for use during these periods.

Problem Statement

Develop a means of storing excess solar energy to be used during periods of no sunlight.

Design Criteria

1. Must be able to supply enough heat to provide 18 hours of heat for a 1200 square foot home.

Evaluation Criteria

1. Cost
2. Amount of heat stored

TITLE Insulation Efficiency

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (5,2,1)

Introduction

The need for energy conservation requires you to select the most efficient insulation material for your home.

Problem Statement

Determine which of the locally available insulation materials is most efficient.

Design Criteria

1. Compare at least 5 materials.
2. Determinations should be based on heat retention.

Evaluation Criteria

1. Accuracy of results

TITLE Electrical Independence

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (2,5,1)

Introduction

In the year 2020, there are no longer any electrical power plants. All homes at this time must produce their own electricity.

Problem Statement

Devise a means by which a home could produce its own electrical energy.

Design Criteria

1. Must be able to produce 10 KW of electrical energy.
2. Must produce 110 volts.
3. Home is located in northern Wisconsin.

Evaluation Criteria

1. Dependability
2. Cost of system
3. Ability to be used in a variety of locations

TITLE Balloon Hovercraft

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2)

Introduction

Future vehicles will no longer use wheels as a drive mechanism. Compressed air will serve as the means of support for vehicles.

Problem Statement

Develop a model vehicle capable of moving on a cushion of air.

Design Criteria

1. Source of compressed air will be a balloon.
2. Vehicle must move at least 5 feet.
3. Vehicle cannot touch the ground.
4. Vehicle should move in straight line.

Evaluation Criteria

1. Distance of travel.
2. Amount of deviation from straight line.
3. Reliability of vehicle.
4. Construction quality.
5. Design originality.

TITLE Balloon Car

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,3)

Introduction

To provide for a clean atmosphere, all automobiles in the future must use compressed air for travel.

Problem Statement

Design and develop a model car capable of being powered by compressed air.

Design Criteria

1. Source of compressed air will be a balloon.
2. Vehicle must be less than 1 foot in length.
3. Vehicle must move in straight line.

Evaluation Criteria

1. Distance of travel.
2. Reliability.
3. Deviation from straight line.
4. Design originality.
5. Construction quality.

TITLE Lighting without Electricity

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,4,5)

Introduction

As the cost of electrical energy used for lighting increases, there will be a need for other methods of providing illumination.

Problem Statement

Develop a method or device to illuminate a room at night without using electricity.

Design Criteria

1. Must provide light equivalent to a 100 watt light bulb.
2. Appearance pleasing.

Evaluation Criteria

1. Efficiency
2. Cost
3. Appearance
4. Safety

TITLE Waste Heat and Cold Utilization

RESEARCH AND DEVELOPMENT
LEARNING ACTIVITY (1,2,3,5)

Introduction

Vast quantities of free excess heat and cold are available during certain times of the year.

Problem Statement

Develop a system for storing winter cold and summer heat to be used at other times of the year to heat and cool a home.

Design Criteria

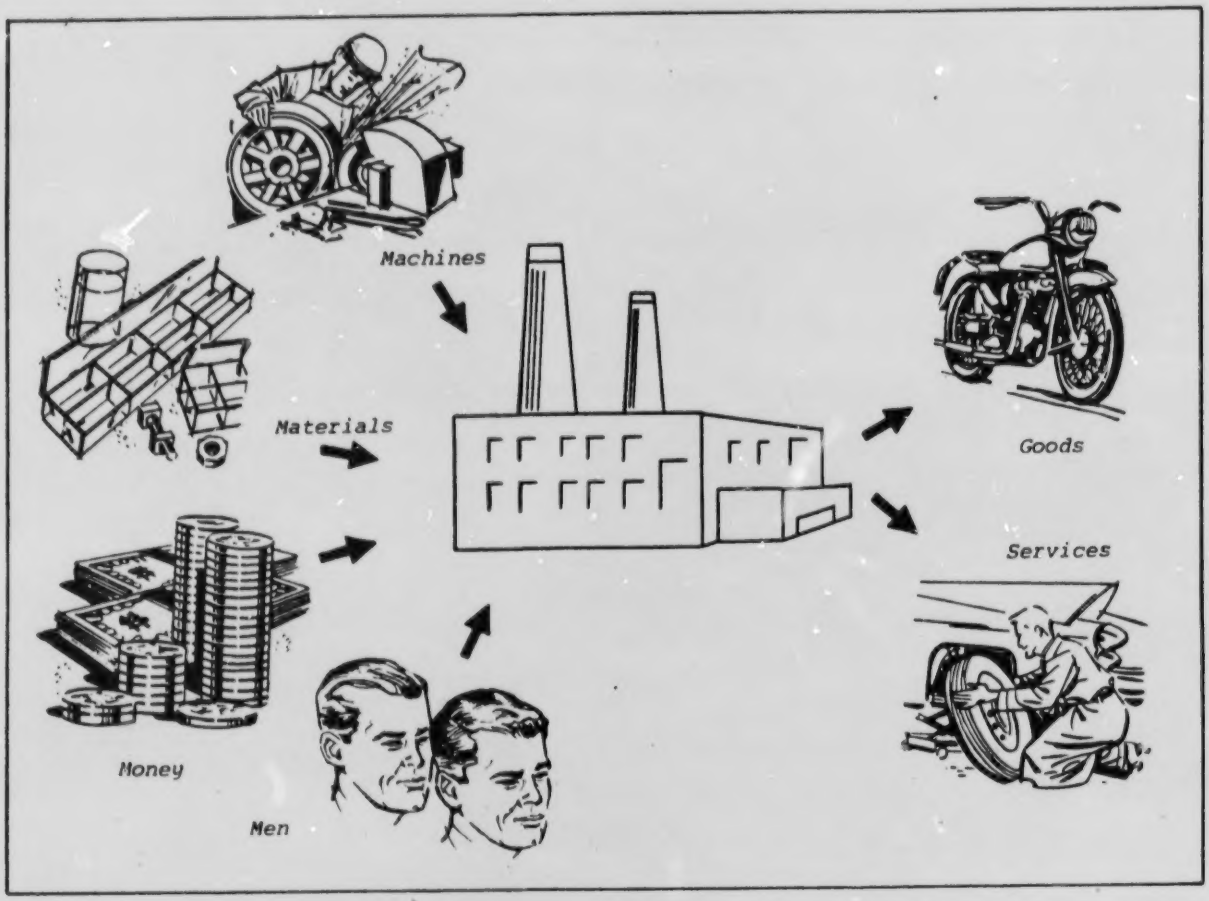
1. Storage
2. Recovery
3. Quantity needed

Evaluation Criteria

1. Loss of heat or cold
2. Cost of system
3. Simplicity

OTHER ACTIVITIES

PROBLEM SOLVING ACTIVITIES



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Marooned in the Past

To the student:

You and your fellow engineers and scientists have perfected a cosmic molecular transporter. This fantastic machine will transport any object, including a man, through time.

It would be impossible to tell if an object had been transported because the object could not communicate its findings to man.

You, then, have volunteered to be the first human to travel through time. You will travel into the past. And even though the years will pass in seconds you will not move from the spot where you are presently standing.

The machine may malfunction and in such a case you may be required to spend a year (or more) marooned in the past. In addition, the controls of the transporter are a little sloppy and you will probably journey back anywhere from 500 to 10,000 years in the past.

The following list represents the articles you can take with you on your journey (most compatible molecular structure with the cosmic transporter). Your task is to place them in order of their importance or priority and then decide on which ones you will take with you.

a life raft
a flashlight and extra batteries
set of encyclopedias
spare clothing
100 feet of rope
pocket knife
an axe
a tent
pots and pans
a deck of playing cards
a set of hand tools
a motorcycle
any other item
fishing equipment
a rifle and 100 shells
a can of gasoline
canned foods
portable radio
money
a small steam engine
a small gasoline engine
a radio (transmitter and receiver)
portable T.V.
The Boy Scout Handbook
can opener
a jeep
10 speed bicycle

After you listed your choices in rank order, eliminate all but the first five choices and explain why they should have priority over the others!

GOOD LUCK - HAVE FUN - BON VOYAGE!!!

*From Engineering Concepts Curriculum Project, Chapter 5, Pages S050101-4

For the Teacher

Paper Airplane Contest

Problem to be presented to the Student:

For many years, airplane manufacturers have been competing against each other in an attempt to build the fastest, biggest, longest flying aircraft. All of the aircraft designers have had to follow rules and constraints and have used similar materials. Why, then, are some planes better than others?

You are going to have an opportunity to answer this question by designing your own paper airplane using the following rules and constraints.

For this contest the CRITERIA for judging are:

distance
time in air
straightness of flight.

The MODEL for this contest is:

a paper airplane.

The CONSTRAINTS limiting how you may build the model are:

one sheet of paper for each airplane
no more than one paper clip for each plane
one-inch of cellophane for each plane
no limit on the number of planes
all flights for each category will be tested by the same person.

The OPTIMIZATION process involves:

designing a plane to meet the criteria as closely as possible
making sure your model includes all the constraints.

Make a paper airplane according to the above rules. You may make one plane that will be good at distance, time, and straightness or you may make two or three separate planes.

Record the information about your planes in the following table. Make as many tests as you wish. The entire class will judge the results after you have finished testing your plane.

The winner will be the person who best meets each of the criteria.

For the Teacher

Mousetrap Vehicle

Problem to be presented to the Student:

As the chief designer for a large auto manufacturer, your fellow engineers have just discovered a new and unique power source for transportation. This new power source has many advantages in that it is extremely economical, emits absolutely no polutants because it does not consume petroleum or chemicals for fuel and it produces high energy output for short intervals. The engineers have given you an accurate working prototype (model) of this new power source and oddly enough, it looks just like a mousetrap!

Your task is to design a working prototype (model) of the finished vehicle using a mousetrap as the power source. As the designer, you must consider a variety of factors, including: size, shape, weight, cost, speed, capacity, simplicity and practicality. It may be some time before your company is ready to change over to mousetrap power. You should, therefore, use production methods and materials that are currently available.

(optional) Make drawings of the finished vehicle showing the dimension and materials used for the finished model. Your drawings should describe the model well enough so that someone else could fabricate the model with no further communication from you. Finally, construct the mousetrap vehicle as you have designed it.

You might want to compare your vehicle with other prototypes designed by your company. This can be done through a series of tests or competitions to determine which design is the lightest, fastest, most dependable, etc.

Note to the Instructor:

The mousetrap vehicle design project should be presented to the student as a problem for his solution. The process of solving the problem should be encouraged rather than placing emphasis on the finished product. The enclosed drawing represents only one solution. The students should be encouraged to experiment with the mousetrap (modification, disassembly) as well as developing a variety of solutions.

GOOD LUCK!!!!

For The Teacher

Egg Craft

Problem to be presented to the Student:

A group of research scientists has recently decided that in the future, spacecraft returning from interplanetary missions will land without the aid of parachutes. This will save considerable weight and necessity for intricate triggering systems. The new spacecraft will land on the ground and will contain internal and/or external cushioning devices to avoid damage to the space vehicle on impact.

The scientists know that it can be done but they don't want to chance damaging a spacecraft or injuring its passengers. They have concluded that a model is necessary for experimentation. They have also found that a raw egg closely approximates the delicate instruments and mechanisms of the spacecraft as well as the impact tolerance of an astronaut.

Your task is to design a vehicle that will carry a raw egg from a four story (variable) building to the ground without breaking the egg and without the aid of a parachute. You may use any materials or design that you wish. You might also consider the following factors: speed on impact, weight, dependability (will it take more than one impact), stability in flight and practicality.

If your design works, submit it to N.A.S.A. (National Anti-Splatter Administration).

Note to the Instructor:

This problem can yield an infinite number of solutions. Encourage creativity rather than emphasizing craftsmanship. You may find it appropriate to discuss some basic laws of physics while working on this problem such as: terminal velocity, gravity, airfoils, the properties of liquids on impact and bound and rebound characteristics of various cushioning devices. The level of difficulty can be increased by establishing certain criteria . . . the craft must weigh at least two pounds, or no more than 8 oz., it must be aerodynamically stable at terminal speed or the egg must be exposed!!

GOOD LUCK!!!!

The Multi System Encapsulator*

Problem to be presented to the student:

The common, everyday, run-of-the-mill, ordinary, household mousetrap has frequently been described as a product that cannot be improved. Inventors have been trying for many years to "build a better mousetrap" but they have had little success.

You are going to have an opportunity to redesign the "mousetrap" by creating a "multi system encapsulator". As the name implies, you will be required to use more than one working system for the operation of your "encapsulator". You must use at least three of the five simple machines (pulley, lever, wheel, inclined plane and screw). The simple machines may be connected in any way and you may use any source of energy to initiate the motion of your encapsulator. The mouse, however, must trigger the energy source or start the working cycle.

Your first prototypes (models) need not depend on the quick reflexes of a healthy mouse. It is permissible to use mice that are blind, arthritic, or confined to wheelchairs. This may be extremely important if the cycle time of your encapsulator is more than 1/2 second.

If you find that this problem is easy to solve, try incorporating a rubber band, balloon or small electric motor. If it's still too easy, try using a live, healthy mouse.

GOOD LUCK!!!

and

HAVE FUN!!!!

*From Engineering Concepts Curriculum Project, Chapter 1, Page S010202

Compressed Air Propulsion

Problem to be presented to the student.

Have you ever imagined yourself speeding through outer space? Have you ever dreamed of designing a vehicle and its propulsion system that would make all other systems obsolete?

In light of the current energy crisis, much attention has been given to alternate sources of power, fuel and energy. Many new inventions are currently available that claim to use small amounts of energy or fuel and are low in harmful emissions. Many of these "new" ideas, however, are simply old ideas that are redesigned or renamed. You are going to have an opportunity to design a vehicle using a power source that is very old but has always been non-poluting.

Your task is to design a vehicle that will operate using compressed air as an energy source. Your container for the compressed air will be a single, large balloon. The compressed air may act directly against the atmosphere (reaction engine) or it may be used to power an auxiliary driving mechanism that will move the vehicle.

Before you begin, it may be helpful (and more exciting) to determine the criteria (rules) that all of the other designs should follow.

Here are some suggested criteria:

A. Design the vehicle for maximum speed over a given distance.(or)

B. Design the vehicle to travel the greatest possible distance.

C. Specify that the vehicle weigh no more than 8 oz. but no less than 2 oz.

d. To increase the difficulty of this problem require that the compressed air act on another mechanism to drive the vehicle.

E. Specify whether the vehicle is to be used on land, water, air or any combinations of the three.

F. Allow only one week to invent, design and construct your vehicle.

G. Use more than one balloon!

GOOD LUCK!!!

and

HAVE FUN!!!!

Future Community Design

To the student:

What kind of community would you like to live in? What would you change or retain from the community in which you now live? This design problem will give you a chance to think carefully about your own personal community of the future!

THE MAP

You are to place 50 homes, apartments, or combinations of both on the property shown on the map.

- The numbers on the contour lines show the elevation in feet represented by the contour lines. These contour lines provide a model of the terrain. You can get more information about interpreting contour lines from a Scout handbook or from a good geology or geography textbook.

- The land is all wooded with the exception of the area marked A. Area A was part of a farm until six years ago. It is covered with grasses, very young trees, and some shrubs.

- There is a major north-south highway approximately 1 mile to the east of this parcel of land, and roads leading to that highway terminate at the edge of the property as marked.

- Running across the parcel is a spring-fed stream that has a moderate flow even during dry weather.

Procedure:

How large is your parcel of land? _____
acres (43,560 sq. ft. = 1 acre)
How much land is that per living unit? _____acres

1. Living Units

Use 50 pieces of paper book matches ½" long to represent living units. Cut the head off each match end and then cut the remaining portion in half to make two units. Each living unit is equivalent to an area 25 feet by 100 feet. You can stack and arrange the matchsticks to represent apartment dwellings, trailers, and private homes. Color code the building models.

2. Build a Model

Make a three-dimensional map of your development. This can be done by cutting out corrugated cardboard in the shape of the contour lines and then stacking the pieces. The type of corrugated board used in many packing boxes (about 1/16" thick) makes the contour lines about 12 feet in elevation. (This is the reason for the contour scale of 12 feet rather than 10 feet.) You will need five 9 x 12-inch pieces of cardboard.

You can make accurate copies of a contour line. Put carbon paper on the cardboard, the map on top of that, and trace a contour line on a sheet of cardboard.

Cut out a rectangle the size of the entire map. The elevation of this piece is 28 feet. Match up the northwest corner of each piece. Cut the 40-ft. contour line with the NW corner in place and glue to the first rectangular piece. Then cut the next highest numbered piece and glue it on top of the previous piece.

3. Plan your community.

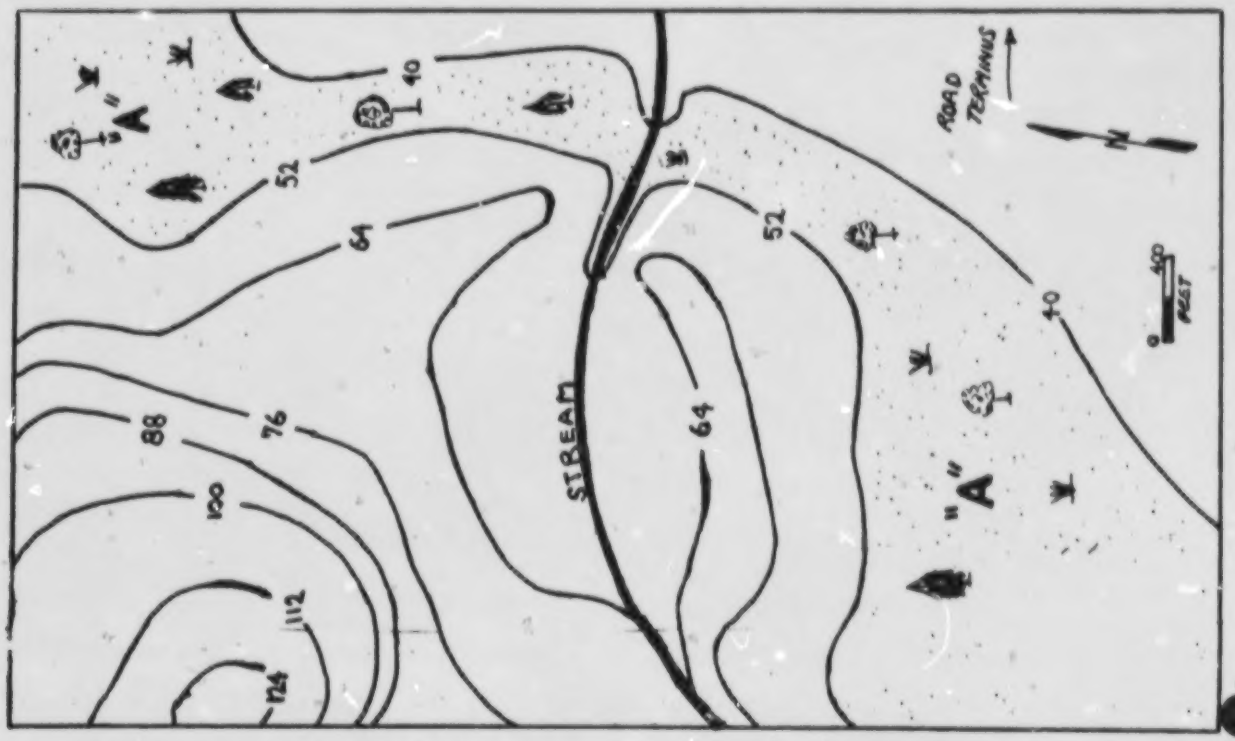
Be sure to account for the following (you may provide some of these things <u>outside</u> your community):

a. Power and water supplies
b. Waste removal and processing
c. Road locations
d. Minimal damage to the natural terrain
e. Recreational facilities
f. A part of total area held as public land
g. Establishment of small shopping area

4. Give your community a name.

5. Write a television commercial.

Actract buyers. Focus attention on one or more of the community's features.



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For the Teacher

Let's Design a Recreational Game

Problem: Your school is located within a heavily populated area. Your students live in areas where there exists a lot of brick playgrounds, walls, and alleys. The weather is pleasant, and it is the time of year when students have a lot of energy to burn.

The problem is to have the students develop some sort of recreational games which can be used in the recreational facilities they have available to them. The ideas can be originals that they may create themselves or replicas of equipment which is commercially produced.

Instruct the students that they may use any tools and machines for which they have received safe instruction and permission to use. They may also use any materials found in the lab and those they would like to bring from home.

Limit the students to a week to work on the design and construction. Be sure to break the class into various groups, this way you will gather more ideas. Keep all work and evaluate it on a creative basis. Explain to the students that they should be creative. Tell them not to worry about craftsmanship, only the explanation of their ideas.

If the students come up with some practical ideas, you may wish to use these for an enterprise or mass production project. There is a possible solution to the problem on the following pages. These designs can be modified to meet the needs of the instructional situation. They may also be incorporated into designs for a production product. The solution listed here is a paddle which is to be used to play paddle ball.

TECHNOLOGY FOR SOCIETY

WISCONSIN INDUSTRIAL EDUCATION ASSOCIATION

THEME FOR *1979*:

EFFICIENT USE OF MATERIALS
&
PROCESSES

Newsletter

Technology For Society
206 Fryklund Hall
Menomonie, Wisconsin 54751

NON PROFIT ORGANIZATION
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MENOMONIE WISCONSIN

PLEASE POST

THE TECHNOLOGY FOR SOCIETY COMPETITION

PURPOSE

Industrial Education teachers of today are concerned that young people learn about the efficient use of materials so that they will be prepared to face, and to make difficult decisions in the future regarding limited material and energy resources.

The Technology for Society contest is being continued to allow industrial education students an opportunity to become intensively involved in investigating and solving problems in a designated technology area through the use of projects and activities.

TOPIC

Technology for Society's theme for this year is EFFICIENT USE OF MATERIALS AND PROCESSES.

PARTICIPATION

Students may participate in the competition as an individual or as a team made up of a small group, large group or class. This participation is purposely left flexible and open. It allows any interested teacher to use the Technology for Society program at some time during the school year.

PROJECTS

Select one or more of the problems in the following three categories:

Category I:	MATERIALS RECOVERY	Problem A:	"Recycling Problem"
		Problem B:	"New Use for Discarded Materials"
Category II:	RESEARCH AND DEVELOPMENT	Problem A:	"Tower of Strength"
		Problem B:	"The Super Toolholder"
		Problem C:	"The Infernal Machine"
Category III:	PROCESSING	Problem A:	"Slippery Corner Slide"
		Problem B:	"No-Waste Bandsaw Problem"

ENTRY FORMS

Complete the entry form below, detach and send to: Tom Baldwin, WIEA Business Manager, Technology for Society, 206 Fryklund Hall, Menomonie, Wisconsin 54751.

ENTRY FORM

WIEA TECHNOLOGY FOR SOCIETY CONTEST-1979

Please register me as a contestant for 1979 in the following categories: (Please check all that apply.)

MATERIALS RECOVERY:	RESEARCH AND DEVELOPMENT:	PROCESSING:
☐ Problem I-A	☐ Problem II-A	☐ Problem III-A
☐ Problem I-B	☐ Problem II-B	☐ Problem III-B
	☐ Problem II-C	

Name: _____ School: _____

Address: _____ Telephone: _____

City: _____ Zip Code: _____

TECHNOLOGY FOR SOCIETY

WISCONSIN INDUSTRIAL EDUCATION ASSOCIATION

PROBLEM I-A "RECYCLING PROJECT"

INTRODUCTION

Resources can be conceived as all the materials man utilizes to satisfy his wants and needs. Traditionally, we have used materials in a rather cavalier manner. We now find ourselves in a position where material costs are increasing and availability is decreasing, increasing the need to "do more with less", as Buchminster Fuller would say. However, methods to economically separate, concentrate and prepare recovered resources must be designed, and the material so recovered must be usable in a new product.

PROBLEM STATEMENT

1. Design a process and/or a product to recover and use waste material.
   a. Waste material can be anything generated in the school environment which is considered a residue of a process and which is normally discarded.
   b. Waste must be used as the raw material for a production process (either applied or potential).
2. Three options are available. These can be applied singly or in combination.
   a. Generate a flow diagram of the recovery process.
   b. Build a model of the recovery process.
   c. Apply the recovery process and generate products.

EVALUATION CRITERIA

A. Complexity of the process
B. Ingenuity
C. Practicality
D. Usability of the product
E. Cost effectiveness of process of product

TECHNOLOGY FOR SOCIETY

WISCONSIN INDUSTRIAL EDUCATION ASSOCIATION

PROBLEM I-B "NEW USE FOR DISCARDED MATERIALS"

INTRODUCTION

Each day tons of used materials and parts are discarded and left to rot or rust away. Many of these items have potential value for re-use or for use in an entirely different way. Reusing products by salvaging them for their original purpose (e.g. using parts from wrecked cars and installing them in other cars) is quite commonly done. Using waste materials/parts and giving them a "new life" in a different product (e.g. making a snack bar stool from the upholstery, wheel and steering wheel/column from a wrecked car) is relatively rare. This problem challenges the student to design and make new products out of old parts and materials.

PROBLEM STATEMENT

Design and construct a useful product from discarded material or parts.

DESIGN LIMITATIONS

The item should be able to be carried or moved easily by two persons.

EVALUATION CRITERIA

The product will be evaluated according to the following criteria:

1. Item completely constructed of discarded materials (waste materials or parts). Fastening devices, adhesives and finishes do not need to be waste materials.
2. The original discarded materials had little or no value in discarded condition.
3. Item developed utilizes the material in a unique and original manner.
4. Energy (other than human) expended during construction is minimal.
5. Workmanship is of high quality.
6. Item constructed has functional and/or aesthetic value.

TECHNOLOGY FOR SOCIETY

WISCONSIN INDUSTRIAL EDUCATION ASSOCIATION

PROBLEM II-A "TOWER OF STRENGTH"

INTRODUCTION

Fundamental structures such as the ones our homes and other buildings are built of are rarely considered by most of us. As a result, we often lack a basic understanding of this structural world surrounding us. This structural problem provides the student with the opportunity to experiment with different ideas and to see first hand through destructive testing just how their structure fares.

PROBLEM STATEMENT

Design a structure capable of withstanding as great a compressive load as possible. Can you hold a thousand lbs.?

DESIGN LIMITATIONS

1. The structure must be constructed of 1/8" square basswood stock.
2. The total amount of stock used is limited to 20 linear feet.
3. The structure must be joined by gluing (Elmers white only).
4. The structure must be at least 12" in height.

EVALUATION CRITERIA

The structures will be judged on their ability to withstand a compressive load. The structure that holds the most weight wins.

TECHNOLOGY FOR SOCIETY

WISCONSIN INDUSTRIAL EDUCATION ASSOCIATION

PROBLEM II-B "THE SUPER TOOLHOLDER"

INTRODUCTION

Tools play an important role in everyday life of all persons. In industrial arts classes, alone, literally hundreds of thousands of tools are used each school day throughout the nation. Properly designed and constructed toolholders will extend the life of the tool, protect the user from injury and save thousands of hours of users time.

PROBLEM STATEMENT

Design and construct a device to hold a specific tool or set of tools which are used in a school industrial arts laboratory.

LIMITATIONS

The toolholder should be able to be stored or mounted in a tool cabinet area measuring no more than 24" x 24" x 36" in size.

EVALUATION CRITERIA

See the attached "Toolholder Check List".

YES	NO	
		1. Toolholders should be sturdily constructed of durable material to withstand heavy, frequent use.
		2. A toolholder should be designed so that only the proper tool can be returned to the empty holder.
		3. A toolholder should protect the tool from damage or undue wear.
		4. A toolholder should be designed so that the tool can be replaced in one position only.
		5. A toolholder should facilitate the swift, easy removal and replacement of the tool: (a) the simplest means of tool removal is a straight off-the-holder motion: replacement is a straight on-the-holder motion. (b) the next simplest means of tool removal is an up-and-off the holder motion; replacement is a down-and-on the holder motion.
		6. A toolholder should support the tool firmly so it cannot be jarred from its proper place by shop vibration, opening or closing doors, etc.
		7. A toolholder should permit quick and easy identification and selection of sized tools.
		8. A toolholder should require simple installation (preferably from the front) to facilitate easy replacement or relocation.
		9. A toolholder should be designed to facilitate a brief visual inspection for missing parts of the tool.
		10. A toolholder should offer the maximum safety protection to those who use the panel.
		11. A toolholder which supports one of several tools of the same size and type should be constructed so that any one of the designed tools will fit into it.
		12. A toolholder which supports more than one tool of the same size and type should have a means of indicating how many tools belong on this toolholder.
		13. A toolholder should support the tool so that its weight causes the tool to hang straight and in proper alignment.

*Adapted from: Pendered, Norman C., Principles for Arranging, Mounting and Storing Hand Tools in Industrial Arts Shops, A research study sponsored by the Central Fund for Research, The Pennsylvania State University, University Park, Pennsylvania (1959)

TECHNOLOGY FOR SOCIETY

WISCONSIN INDUSTRIAL EDUCATION ASSOCIATION

PROBLEM II-C "THE INFERNAL MACHINE"

INTRODUCTION

Here is a problem that is wide open in nature. The student or students have the opportunity to flex their creative genius and come up with some crazy, fun, and unusual solutions. At the same time, the student will be dealing first hand with various materials, simple machines, and several forms of stored energy.

PROBLEM STATEMENT

Given a steel ball (ballbearing), five-eighths of an inch in diameter, design a device that will keep this ball moving (in motion) for precisely ten seconds. At the end of the ten seconds, the ball, or some process activated by the ball, will light a wooden match.

DESIGN LIMITATIONS

1. The device must be self contained and fit within four cubic feet of volume.
2. There are no material restrictions.
3. No explosive or potentially dangerous devices may be used to ignite the match.

EXAMPLE

One imaginative solution involved a funnel supported on one side by a spring and on the other side by a balloon filled with air. The steel ball, released by a pinball spring, whirled interminably in the funnel. At the same time the ball was released, a water column began to descend down a small pipe marked off in seconds. After rounding a bend, the water began to rise, still under pressure, floating a small cork fixed with a pin, its point projecting upward directly beneath the balloon. At precisely ten seconds, the balloon popped, upsetting the balanced funnel, dropping the steel ball directly onto a mouse trap arrangement holding a wooden match which struck an overhead piece of emery paper, thereby igniting.

PROBLEM II-C "THE INFERNAL MACHINE"

(CONTINUED)

EVALUATION CRITERION ITEM CHECKLIST

1. The ball must stay in motion for exactly ten seconds.
2. The match must light.
3. The solution is creative and unusual.
4. The workmanship is of high quality.

TECHNOLOGY FOR SOCIETY

WISCONSIN INDUSTRIAL EDUCATION ASSOCIATION

PROBLEM III-A "SLIPPERY CORNER SLIDE"

INTRODUCTION

Machine slides are used throughout the machine tool industry. The milling machine, lathe, surface grinder and shaper would not be possible without the application of slide devices. The slide mechanism illustrated in this problem only slides one direction and like many slides, it is made from two separate pieces of metal that will slide apart. This slide might be used on a 45 degree mitering machine or in many machines for that matter.

To fit your particular shop equipment, this slide can be made complete on a milling machine, or a lathe or a shaper and possibly other types of equipment.

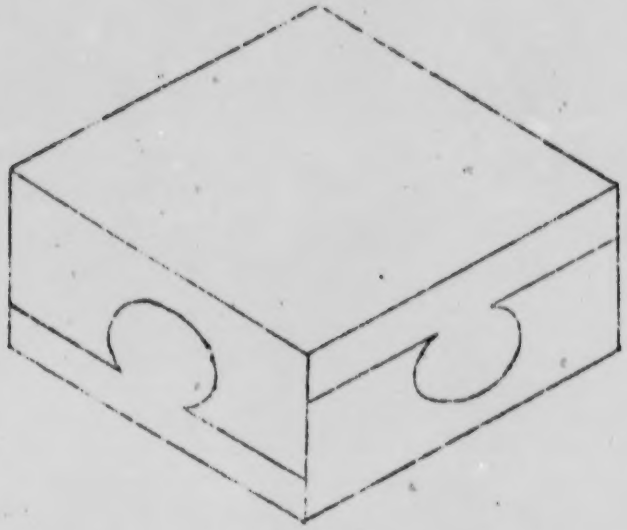
PROBLEM STATEMENT

Machine the illustrated slide mechanism from metal of your choice to the specified size and surface finish tolerances. Fabricate the problem as efficiently as possible taking the least possible steps.

EVALUATION CRITERIA

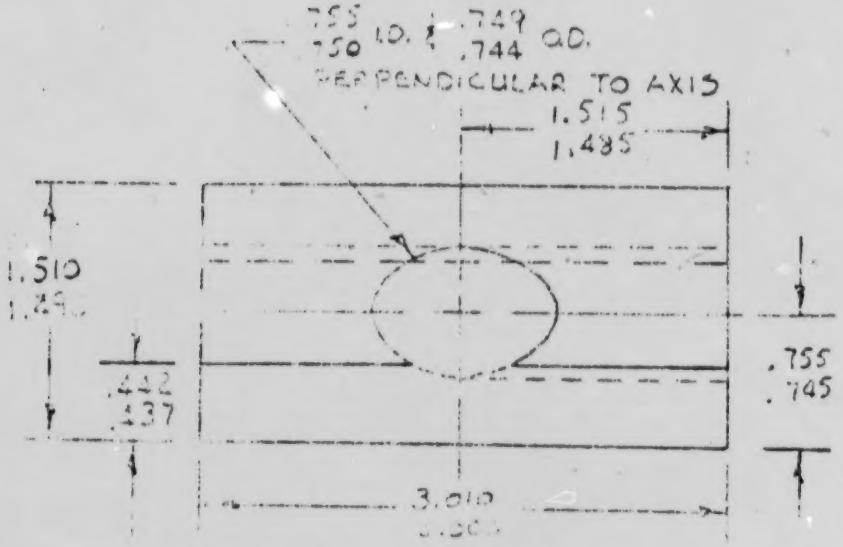
Each entry will be judged with the following criteria:

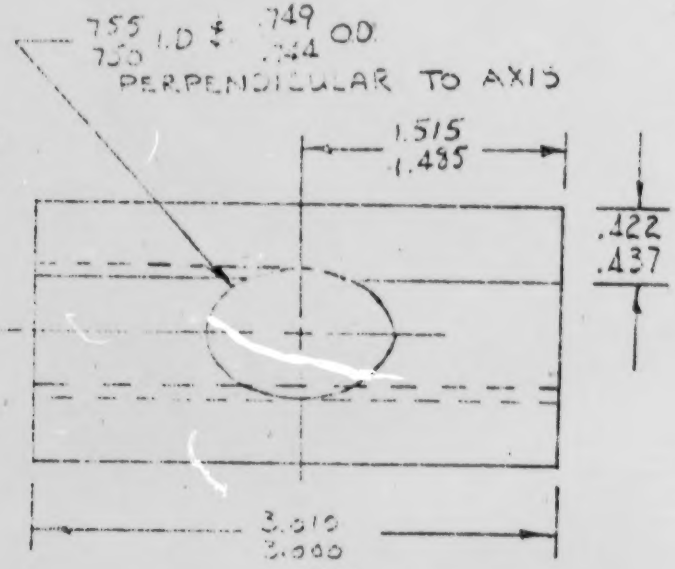
1. Sizes within specified tolerances.
2. Surface finish within the specified tolerance.
3. Least number of steps and tooling in its fabrication.
4. Angular tolerances maintained on all corners.



SPECIFICATIONS
FINISH 63 AA OR BETTER
So. ± 1°
CHAMFER ALL CORNERS 45° X 1/32

SLIPPERY CORNER SLIDE





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TECHNOLOGY FOR SOCIETY

WISCONSIN INDUSTRIAL EDUCATION ASSOCIATION

PROBLEM III-B "NO-WASTE BANDSAW PROBLEM"

INTRODUCTION

Usually when projects are made from wood a lot of material is discarded as waste. Some of this waste is necessary, but through careful planning much of it can be reduced. The purpose of this problem is to show how new shapes and forms can be made with little waste while using one principal machine--the bandsaw.

PROBLEM STATEMENT

Design and make a three-dimensional object from a block of wood using the bandsaw as a primary shaping tool.

LIMITATIONS

The objects must originate from a piece of wood no larger than two board feet in size.

EVALUATION CRITERIA

1. After initial squaring of the block, the primary method of shaping is band sawing. (Note: Secondary methods may include fastening with adhesive or mechanical fasteners and smoothing).
2. Waste after squaring is limited to the kerf made by the bandsaw and minimum smoothing with abrasives.
3. The object is complete in itself and not a portion of another object.
4. The completed product has appropriate surface finish.
5. The product is unique and original.
6. Workmanship is of high quality.
7. The product has functional and/or aesthetic value.
8. The process is not forced (design is appropriate for the process).

A Teacher Directed Problem-
Solving Activity

"LET'S MAKE A CATAPULT"

By:

Thomas Burt

Designed to Relate to Field Objective Number One
and the Following Industrial Elements:

Research and Development Production

Materials Human Resources

Communications

For the Teacher

Let's Construct a Catapult

Problem to be presented to the Student:

Imagine yourself a medieval arms supplier. Your king's most eminent general has come to you with a tale of a device, used by a neighboring and unfriendly country's army, which is capable of throwing large rocks long distances. The device, he says, is called a catapult. He is concerned for your country's national security and he believes that the present catapult gap between the two countries could result in a defeat in future wars for your side.

He has charged you with responsibility for the design and construction of a working model of a catapult. So serious is the situation that you have only two weeks to complete the prototype model. Failure to meet the deadline will likely have dire consequences, for your king has been known to behead subjects for less serious failures.

Your model should incorporate design features which will permit it to meet the following performance criteria:

1) Throw a one ounce weight a distance of at least 30 feet.

2) Height of trajectory and distance to impact can be varied by adjustment of the catapult.

3) Unit is mobile (mounted on wheels) and light in weight

Note to the Teacher:

Included with this package is a drawing of one possible solution to the catapult design problem. Students could be directed to designs of similar, or greater or lesser complexity. Another approach would be to present the drawing as a starting point for a re-design activity. In either case, it is suggested that greater emphasis be placed upon the creative process of design rather than upon high standards of craftsmanship in production of a prototype.

Safety Note:

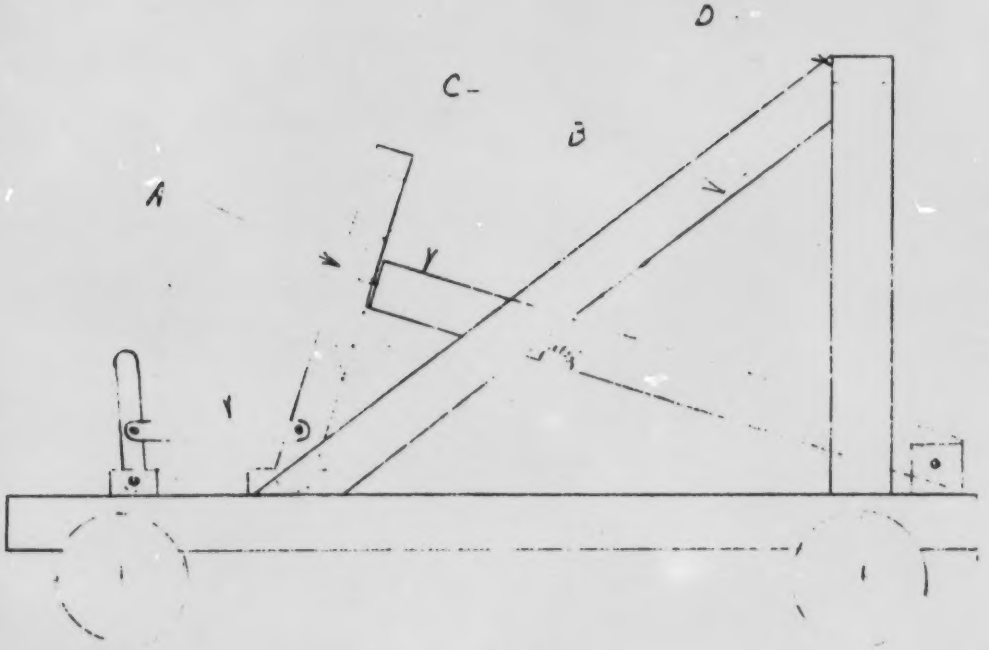
As the project nears completion, students might want to test their prototypes. This activity should be carefully supervised to avoid possible student or teacher injury!

A-Ratched trigger device permits range to be varied

B-Heavy rubber bands or rubber upholstery webbing provides power

C-Depression in launch arm holds projectile

D-Rubber pad on cross bar will absorb shock of impact of launch arm



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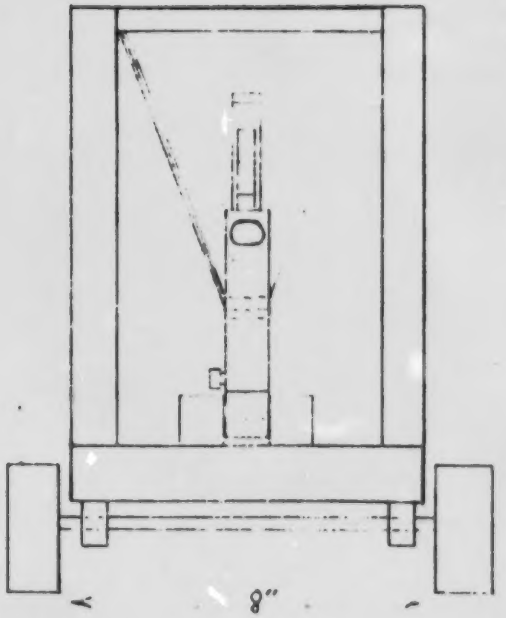

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A Teacher Directed Problem-
Solving Activity

"LET'S BUILD AN ELEVATOR"

By:

Thomas Burt

Designed to Relate to Field Objective Number One
and the Following Industrial Elements:

Research and Development Production

Materials Human Resources

Communications

For the Teacher

Let's Build an Elevator

Problem to be Presented to the Student:

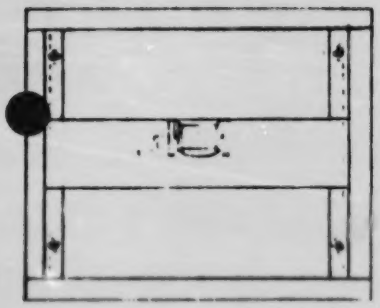
Suppose that you are an architectural engineer. The firm you work for has the job of designing a three-story building. You have been assigned the task of designing an elevator for this building. The elevator is primarily for use in transporting freight. The shaft is to have four doors, three which are for access to the three floors of the building. The fourth is opposite the doors to the three floors and provides access to a loading dock. The level of the loading dock is eight feet above the first floor level and four feet below the second floor level. The elevator cage then, must have access doors at both ends. The building will be 36 feet tall, with the distance between floors being 12 feet.

Your task is to design and build a model of an elevator suitable for use in this building. The scale of the model should be 1" = 1'. Begin your design task with the collection of information on the design and construction of elevators. Consider the following factors while you make your design: size, weight, capacity, speed, controls, and safety. Your model should include the elevator shaft, the cage, the lifting mechanism, and power for the lift. As you design the elevator, be sure to keep in mind the materials and equipment you will have available for construction your model.

Make drawings of the elevator depicting the dimensions and materials for the finished model. Your drawing should describe the model well enough so that someone else could fabricate the model with no further communication with you. Finally, manufacture the elevator model as you have designed it.

Note to the Instructor:

The elevator design project should be presented to the student as a problem for his solution. The emphasis in the project should be upon the process of solving a problem rather than on the finished article. Suggestions to students who are stumped by the problem might be best made in the form of questions which lead to solutions. Enclosed with this package is a drawing on one possible, simple solution to the problem. It could be used for a redesign approach to the problem.



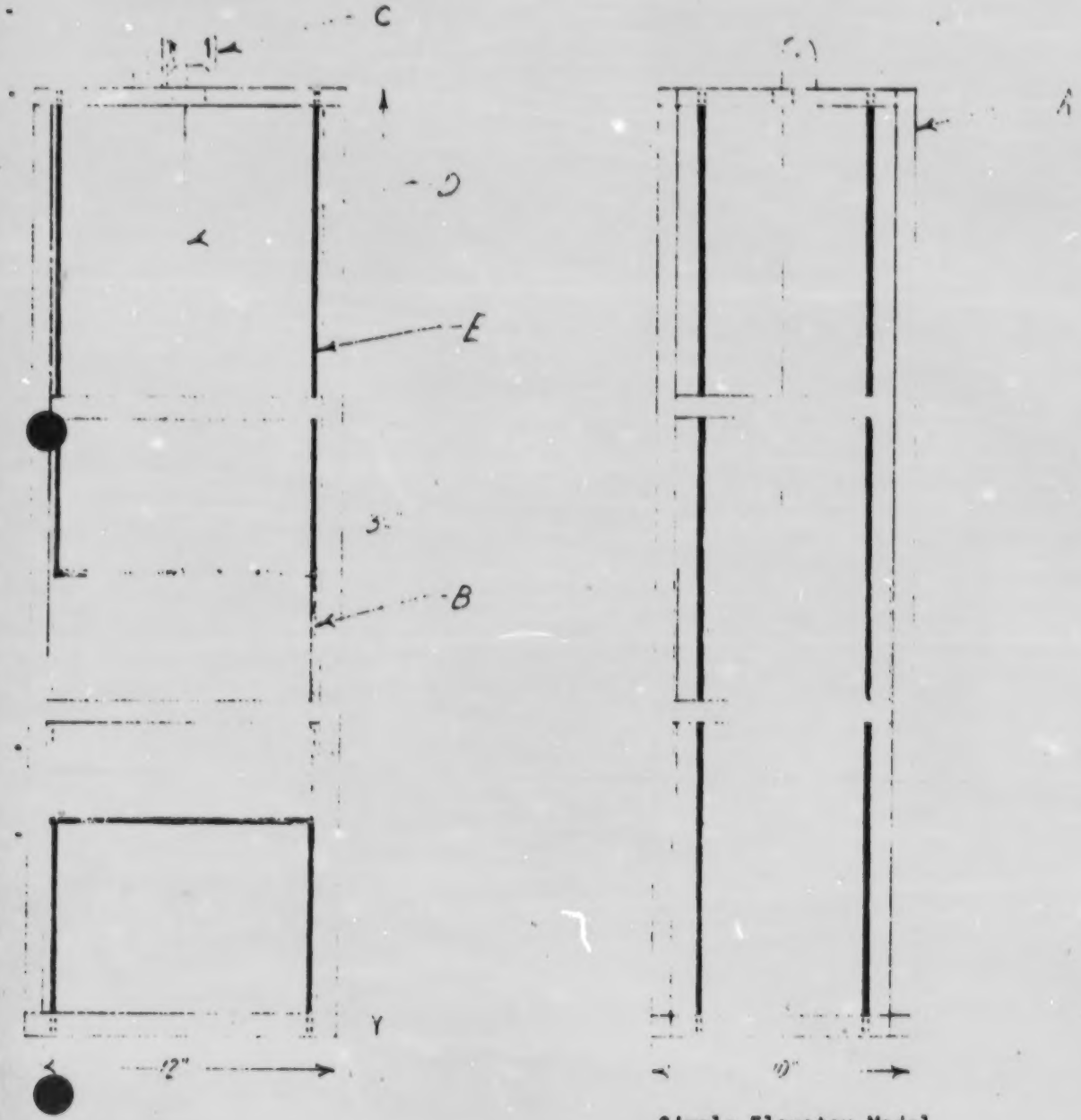
A-Wood frame, 3/4" members

B-Cardboard or 1/4" plywood elevator cage

C-Hoisting mechanism consists of sewing thread spool mounted in frame with crank attached to axle

D-Heavy thread lift cable

E-Cage guided by 1/8" steel rods which fit into grooves on cage sides



Simple Elevator Model

To the Instructor:

Here are three activities center around kite building:

1. A problem solving activity
2. A mass production activity
3. An individualized activity

(A kite is used, but keep in mind that any item or product students are interested in making could be used in its place.)

1. The problem solving activity can be used to discuss and relate the types of processes the students performed to design the kite to the types of processes industry performs to design a product. For example, such things as research and development, building a prototype, testing, etc., can be discussed.

An example of a handout to get the students started (with some guidelines) is provided on page 4.

Some construction techniques and design ideas are also included. These can be given to individual students who may need some ideas to get started. These can be found on pages 5-12.

For those students who are less capable, the individualized package can be employed in place of the problem solving activity. This starts on page 13.

2. A mass production activity could also be employed to produce a kite. The following are some suggested activities and their relationship to industry:

- produce one of the better kites from the problem solving activity. (Research and Development)
- the class could vote on the kite they would like to produce. (Management)
- ask around school, at lunch, etc., and see how many people would be interested in buying a kite, and how much they would be willing to pay. (Market Survey)
- organizing the venture. (Management)
- obtaining money to buy materials and to start production. (Finance)
- getting everyone involved. (Relationships)
- produce a drawing of the product. (Communications)
- design of jigs and fixtures. (Production)

- layout a design or lettering on kite, (school name) e.g. screen process, printing, etc. (Graphic Communications Advertising)

- selling the product. (Profit or Loss, Marketing, Distribution)

3. A third alternative is an individualized activity. This could be used by less capable students or those who cannot handle the problem solving activities. An example is provided for the instructor that he can give students at his discretion. This starts on page 13 of this package.

For more information:

Hunt, Leslie L., 25 Kites That Fly, New York; Bruce, 1929

LaBerge, Armand J., Boats, Airplanes and Kites, Peoria, Illinois; Manual Arts Press, 1935

Miller, C.M., Construction and Flying of Kites, Peoria, Illinois; Manual Arts Press.

Chicago Park Board, Kite Craft and Kite Tournaments, Peoria, Illinois, Manual Arts Press.

Downer, Marion, Kites, New York, New York, Lothrop, Lee and Shepard Co., 1971.

For the Teacher

Designing a Mobile

Problem: The problem for this activity is to have the students design and construct a mobile to hang in their room at home.

The students should be instructed that they may use any tools or machines which they have received safe instruction and permission to use. They may also use any materials found in the lab and those they would like to bring from home.

Explain to the students that they should combine creativity and craftsmanship in producing the mobile. They should combine various materials and processes to produce an attractive product. They could possibly use wood, metal or plastic to make the structural support of the mobile. Thread or fishing line could be used to hang the objects from the structure. The objects to be suspended could be processed from clay, wood, metal, paper, or plastic. Processes which could be used to place designs on the suspended objects could be silk screening, painting, forming, etc.

Limit the students to a week to work on the design and construction. Be sure to break the class into various groups, this way you will gather more ideas. Keep all work and evaluate it on a creative and craftsman basis.

If the students come up with some practical solutions you may wish to use these for an enterprise or mass production project. There is a possible solution to the problem on the following pages. It can be modified so your class can use it. The length of thread and distances where they are located may need to be moved so the structure will balance, depending on the types of materials used.

A Teacher Directed Problem-
Solving Activity

"THE ELECTRO-MAGNETIC CRANE"

By:

Thomas Burt

Designed to Relate to Field Objective Number One
and the following Industrial Elements:

Research and Development Production

Materials Power and Energy

Human Resources Communications

The Electro-Magnetic Crane

To the teacher: The following should be read to the class.

In order to demonstrate how electricity can be used in combination with mechanical devices, you are assigned to design and construct a small functioning model of an electro-magnetic crane. These are the types of cranes often used in salvage yards or in other operations to pick up steel and iron scrap. Their operation is somewhat similar to large excavating power shovels (you may have called them steam shovels). But, rather than scooping up materials, the electro-magnetic crane uses a large electro-magnet which, when energized, has a powerful attraction for iron and steel. The magnet then, holds the material until it is moved to the proper point. Power is cut from the magnet and the load is released.

In your design of a small model of such a crane, you should aim for a device which can pick up small iron and steel objects and move them short distances to where they can be dropped into waiting model railroad cars, trucks, etc. You should use flashlight type batteries for powering the electro-magnet, and pine lumber for the body of the crane.

Encourage the students to use innovative ideas in designing the crane. Some of them may want a crane that could be used as a part of a model railroad layout. Although the crane must function properly to illustrate the principles involved, it may be a good idea to stress the creative process rather than high standards of craftsmanship.

When the design is completed and the model built, spend some time discussing the electro-magnetic crane. Cover the problems the students

had with their model and try to get them to think of the problems associated with the design and use of a real industrial electro-magnetic crane. Cover safety, strength requirements of the boom arm, mobility, etc.

A Teacher Directed Problem-
Solving Activity

"LET'S MAKE A HAND-FISHING REEL"

By:

John Ritz

Designed to Relate to Field Objective Number One
and the Following Industrial Elements:

Research and Development Production

Materials Human Resources

Communications

The following industrial elements can also be
incorporated into this activity:

Marketing and Distribution

Finance Management

For the Teacher

Let's Make a Hand Fishing Reel

Problem: Since fishing season extends most of the year in Wisconsin and many of the students enjoy this form of recreation, why not experiment to design a fishing device which is cheap to produce and easy to carry with you. You should present this problem to your class and see what solutions they can develop. Be sure to stress that you want a device that is cheap to make and easy to carry, but will successfully catch fish.

Instruct the students that they may use any tools and machines which they have received safe instruction and permission to use. They may also use any materials found in the lab and those they would like to bring from home.

Possible designs for the hand fishing reel could be made from wood, plastic, metal, etc. Explain to the students that they should be creative and not to worry about craftsmanship. The creativity is the important thing to look for in each design.

Limit the students to a week to work on the design and construction. Be sure to break the class into various groups, this way you will gather more ideas. Keep all work and evaluate it on a creative basis.

If the students come up with some practical solutions, you may wish to use these for an enterprise or mass production project. There is a possible solution to the problem on the following pages. These could be used as the designs for a production product.

IDEAS, ETC.

TEACHING IDEAS

BULLETIN BOARD

One method of stimulating interest within or outside the class is to have students make a bulletin board. If projects are being developed, have the students make a sketch or find a picture of the proposed product at the beginning; and upon completion, add a photo showing the results. If the Research and Development activity involves a group project or development of a process, use the bulletin board to explain ideas or show how the problem is being solved. These types of displays are attractive, interesting and stimulating for students, parents, teachers and visitors.

EVALUATION

In the process of evaluating Research and Development students, quite often difficulties are encountered in how to do it effectively. In many cases, there will be no right or wrong solution to a particular problem. Also, at times, students may be working for extended periods of time on their own in an unstructured situation. One possibility of evaluation under these conditions is the use of a weekly progress sheet (shown on next page).

The intent of this method is to provide students an opportunity to see on what and how they are being evaluated and allow them to take an active part. It was developed for lab-type work, but it has possibilities in other situations as well. When introducing this system, it's important to explain to the students why it is being used. Point out the advantages and importance to them. Also, explain how it will be done, and give them assistance in filling out sample copies.

The items listed on the left side of the form represent areas in which evaluation is to take place. There has been a conscious effort to include areas that are not normally evaluated directly. Each week the students fill out a detailed report of progress for that week. They evaluate themselves according to the scale given. The point breakdown on the scale was determined by the importance of each item. The point system could total 48 so division by 4 would translate to a scale of 1-12 that can easily be transferred into letter grades.

After the student self evaluation, the instructor reads the detailed report of progress and, along with observations, gives his evaluation

including comments. When returned to the student, he/she is able to see strong and weak areas and can then discuss these problem areas with the instructor.

DATE _____ NAME _____

GRADE _____

WEEKLY PROGRESS SHEET

ITEM	POINT BREAK DOWN	POSSIBLE POINTS	SUTDENT	INSTRUCTOR
COMPLETION OF FORM	3-good 2-average 1-poor	3		
ATTENDANCE	1-each day	5		
USE OF TIME	5-good job 3-average 1-poor job	5		
CLEAN UP	3-good 2-average 1-poor	3		
ATTITUDE AND COOPERATION	10-excellent 5-average 1-poor	10		
PROGRESS AND QUALITY OF WORK ON PROJECT	15-excellent 10-good 5-so-so 1-poor	15		
WORKS SAFELY	5-excellent 3-good 1-fair	3		
TOTAL POINTS		44		

DETAILED REPORT OF PROGRESS

ADDITIONAL PROBLEM IDEAS

1. Move an object without human hands touching it.
2. Design a method to reproduce identical cylindrical shapes of wood.
3. Study the by-products of burned fuel from an engine.
4. Investigate why internal combustion engines require a rich air-fuel mixture at high speeds.
5. Investigate and test different weights of oil to determine which would function best in extreme cold or heat (best all-season oil).
6. Design a dwelling that is energy self-sufficient.
7. Design living quarters using any available materials at a cost of $20,000 or less, including the land.
8. Design a living structure that has no permanent dividers to separate living areas but still provides for necessary privacy.
9. Create an ad to sell a product.
10. Design a product which can be mass produced in the shop which will sell well and return the most profits to the investors.
11. How will you advertise a 100 per gallon carburetor?
12. How can we provide energy for a home without the elaborate distribution system?
13. Determine what type of industry would benefit your community the most.
14. Determine what effects a large industry coming to a small town will have.
15. Design a robot to do something.
16. You are 10 feet away from the blackboard and you want to write on it.
17. Here is a waste product, no place to put it, a need to conserve, or some other parameter.
18. If you found out you only had 6 months to live, what would you do in that time?
19. Determine what influences people liking each other.
20. Develop a device that would tell you the time at night.

21. Develop a method to reduce the noise produced by a wood planer.

22. Design a storage and display method for hunting supplies.

23. Design an animal shelter from waste material.

24. Develop a method for temporary storage and separation of waste materials at home (glass and metal cans).

25. Design a method of storing and recovering small pieces of wood, plastic, or steel stock.

26. Using waste 1 gallon cans, design a useful product.

27. Design a napkin holder using one square foot of sheet plastic.

28. Design and build a storage and work area for business materials.

29. Build a device to store and view common canned goods found around home.

30. Develop a method of sorting and storing small childrens' toys.

31. Test different types of wood joints for strength, time to make, apprearance.

32. Test various types of adhesives for strength, drying time, cost, water proofing.

33. Design and build a model for a drying device for painted or varnished parts.

34. Investigate the methods by which industry could raise money giving advantages and disadvantages of each.

35. Determine what factors should be considered by an individual in choosing an occupation.

36. Develop a list for sources of information on solar energy.

37. Develop a plan for a new community showing location and giving justification for each structure.

38. Develop a scale model of a living structure that requires no more than 15^{0} of added heating or cooling.

39. Develop a method of providing light for a room automatically only when some one is in it.

40. Develop a method by which you could store and retrieve ideas without writing them down.

41. Design and build a vandal-proof towel dispenser.

42. Develop a method of inspecting the quality of products not utilizing any human beings.

43. Develop a list of all the methods by which metal is fabricated together.

44. Develop a system of monitoring the safety of an auto exhaust system.

45. Develop a method to prevent cars from rusting.

46. Develop a method of having roads safe to drive on in winter without using salt.

47. Develop a method for using waste heat produced by a clothes dryer.

48. Develop a method of casting metal using disposable patterns in a one-piece mold.

49. Design a device to protect a bicycle from theft without using a chain, cable or lock.

50. Develop a home for a family of four in 500 square feet.

51. Develop a method of determining temperature without using a thermometer.

52. Determine a method of becoming educated without going to school.

53. If you were going to be stranded on an island for 10 years alone and could take along whatever you could carry, what would you take?

54. Design an efficient human waste disposal.

55. Using a rocket engine, design something which will climb to the highest altitude. (May have problems)

56. Make X number of high quality rockets in the shortest number of class periods.

57. Design a fixture for a machine to meet this design requirement so all parts produced will be uniform.

58. Design a totally automated system of placing holes in a board.

59. Design a method of storing letters and keys.

60. Design and build a scale model rock crusher capable of crushing sandstone or dried clay to simulate the shale-crushing process.

61. Design and construct an ant farm-like scale model of the "in-situ" retorting process.

62. Investigate present land restoration procedures in strip mining and develop economical alternatives.

63. Design and build a working model of a "reversible pump turbine".

64. Design and construct a simple turbine that would allow different pitches in the vanes to be used so the torque could be measured.

65. Design and construct a cross section of one or more of the geothermal reservoir types in an ant farm-like fashion.

66. Design and construct a scale model of a drilling rig used to tap geothermal resources.

67. Design and construct a scale model geothermal electric generating plant.

68. Design and develop a scale model showing how a centrifugal separater separates steam from super-heated water.

69. Design and construct a scale model of a nuclear power plant including a mock reactor and conversion units.

70. Develop a system to supply supplemental heat for classroom using solar energy.

71. Reduce heat loss up chimney from wood-burning stove.

72. Move a one-pound weight a distance of twenty feet on a vehicle using no wheels or attached lines.

73. Develop a means of utilizing waste stored in your city dump.

74. Develop a means of using the energy of a running stream.

75. Construct a device which will convert the available energy in wood to heat.

76. Develop a means of using the available energy left in sawdust from a sawmill.

77. Design a system capable of moving spent shale having the consistency of fireplace ash.

78. Develop a process which will remove the pollutants from coal-fired power plant.

79. Develop a device which, using human power, supplies enough energy to light a 100-watt light bulb.

80. Construct a device capable of producing temperatures high enough to ignite wood chips.

81. Construct a device which will convert sunlight into heat capable of being used in heating a home.

82. Construct a device capable of lighting a 100-watt bulb using only the power of the wind.

83. Construct a device which will determine how much radiation you are receiving at a given time.

84. Build a device capable of cooking a hot dog in five minutes using the sun for energy.

85. Determine which type of insulation is the most effective insulation.

86. Determine which insulation material is most fire retardant.

87. What jobs will not exist in the year 2000.

88. What job will be in greatest demand during 2000.

89. How can we get coal from western coal fields needed by society when farmers don't want to lose their land.

90. You have invented a carburetor yielding 100 mpg. You must form a company that can produce 100,000 of these carburetors per year.

91. Determine labor cost of factory employees per auto.

92. You are going to start an automobile manufacturing facility. Determine what skilled, semi-skilled and unskilled occupations are required.

93. A coal-fired power plant is being built one mile from your hometown. Determine the advantages and disadvantages of it.

94. Determine what type of industry would benefit your community the most.

95. How can electrical energy be transmitted without affecting the environment and with minimal land use.

96. Determine the result effect moisture content has on the strength of edge-to-edge glue joints.

97. Determine the shrinkage of various woods when dried to a M.C. of 6-8%.

98. Determine which woods are best suited to steam bending.

BRAINSTORMED ACTIVITIES

1. Using waste materials, develop a useful item.
2. Using rubber band (or other source), transport a given weight the farthest.
3. Test glue joints to determine a set of standards.
4. Make a source of light for reading.
5. Develop a storage area for books, storage, work area, etc.
6. Develop an outside play device for children under five.
7. Develop a package to hold an item.
8. Develop a seating device for a park.
9. Design and make a model of a home that needs a minimum of insulation or energy to heat or cool the structure.
10. Taking common side materials, design a wall covering in a house other than what is normally done; to cover a ceiling area.
11. Design a walkway across a yeard that is decorative, but not a sidewalk.
12. Here are some materials (scraps, specific materials, new material). Design and develop a use for it. (Common materials, but not commonly used - like scrap).

Robert Hendricks
Industrial Education
PRODUCT DESIGN & DEVELOPMENT

NAME_____

MODS_____ FOLDER_____

RATIONAL: Designing is the complete act of creating a product. When you design a project, you must plan it completely and also make a set of working drawings.
The design process is in 3 parts:

CREATIVE - this is the expression of your own ideas and feelings into the design

TECHNICAL - this part is the ability to first make the working drawings, and then the ability to work from the drawings using tools skillfully to actually build the product.

AESTHETIC - this is the ability to design something that appeals to other peoples senses.

REQUIRED WORK

- ☐ - Study the design limitation and variables chart PAGE 1
- ☐ - Draw a minimum of 4 thumbnail sketches of possible products PAGE 2
- ☐ - Draw 2 preliminary sketches, actual size. PAGE 3
- ☐ - Show these sketches to your ACOUNTABILITY PERSON for approval. He will OK your work. PAGE 3
- ☐ - COnstruct a working drawing of your product, top view only, with dimensions.
- ☐ - Complete the Bill of Materials Section PAGE 4
- ☐ - COmplete the Planning Procedure Section PAGE 4

COMPANY OVERTIME OPTIONS

# INDUSTRIAL DOLLARS	ACTIVITY
Up to 4	Obtain a piece of green drawing paper from your ACOUNTABILITY PERSON. Make an Isometric Drawing of your proposed product that could be used in advertising.
Up to 4	Think up an idea for a possible product that your entire company could produce for sale. Puzzles, games, etc. are good products. Make a working drawing of the idea. Get approval from your ACOUNTABILITY PERSON <u>BEFORE</u> you begin.

Industrial Education
PRODUCT DESIGN & DEVELOPMENT
Design Limitation and Variable Chart

PROBLEM: You are to assume that you are an Industrial Designer. Your company has given you the responsibility of designing a product that:

1. Will provide a place for important keys to be stored when not needed. Examples: garage key, suit case keys, car keys, extra house keys, etc.

2. Will hold important letters that are to be mailed the following day.

3. Can be fastened to a wall, probably near an entrance.

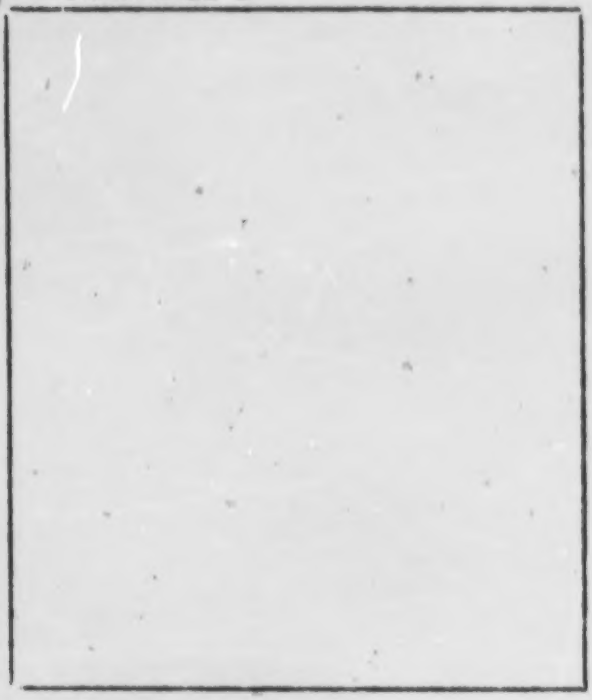
After studying the problem, you must learn what constants and variables you have to work with. The chart below provides all information needed to design the above mentioned product.

DESIGN FACTOR CHART		
FACTORS	LIMITATIONS	VARIABLES
Length	9" at one point	--
Width	----	1½ - 4"
Thickness	3/4"	----
# of Keys Held	---	2-4 sets
Method of Hanging Keys from Device	L hooks	----
# of Letters Held	---	2-5
Method of Holding Letters	Saw Kerf	----
Method of hanging Device	Hole for Nail	----
Finish	---	Natural-Deft Stain-Deft

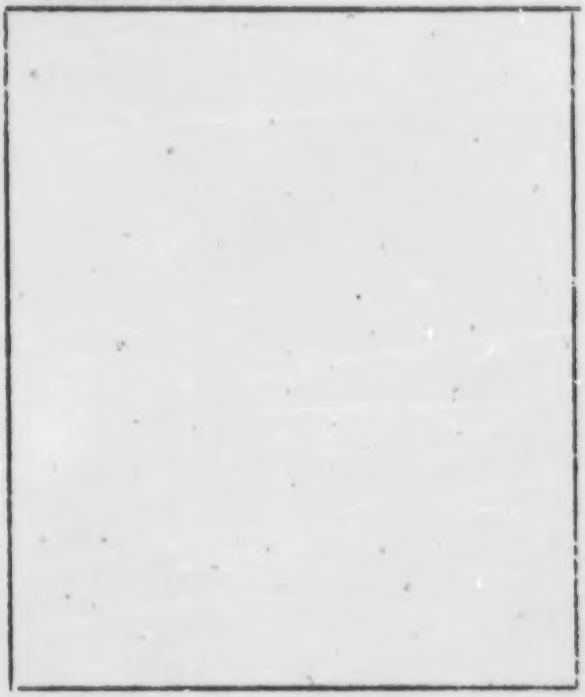
Industrial Education
PRODUCT DEVELOPMENT & DESIGN

THUMBNAIL SKETCHES

Thumbnail 1



Thumbnail 2



Thumbnail 3

Thumbnail 4

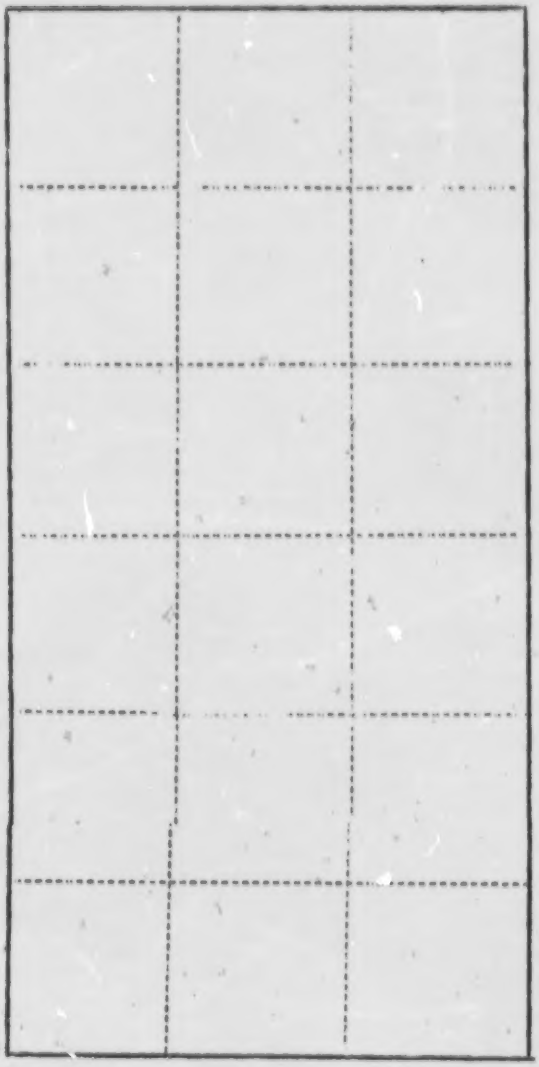
NOTE: The only tools needed are pencil & paper ---we've given you the paper. TRY TO GET A VARIETY OF IDEAS.

Industrial Education
PRODUCT DESIGN & DEVELOPMENT

PRELIMINARY SKETCHES

Problem: Pick two of your thumbnail sketches and sketch your best ideas in the space below. The grids are 1" apart. Include all dimensions needed to layout the design on a piece of wood.

Preliminary 1



Preliminary 2

I have seen above sketches, and approve _____ for final drawing.

_____
Acountability Person

Received Paper_____

Industrial Education
PRODUCT DESIGN& DEVELOPMENT

PLANNING SHEET

Designers Name _____ Date_____ Mods_____

Project Description:

BILL OF MATERIALS

No. of Pieces	Description and size of Part	Cost Unit	Cost Total
		Total Cost	

PRODUCTION ORDER
(PLAN OF PROCEDURE)

Step #	Operation	Machine/Tool
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	(Continue on another Sheet if Needed)	

PROBLEM SOLVING APPROACH TO DESIGN

170-205 Design for Industry

Name _____

Implementation of Objective

Given an independent design problem (either self-chosen or assigned), the student will be able to state the problem, analyze the problem, write a list of criteria to be fulfilled, propose several solutions, select the best solution and construct a prototype which best fulfills the need.

Independent design. In this lesson, you will learn how to define a need or a design problem and develop a list of criteria (checklist) which will be the guiding principles for your solution to the problem.

The recommended procedures for solving design problems in Industrial Arts has five basic steps:

I. State the Problem (need)

II. Define the Problem

III. Conduct Research

IV. Propose Possible Solutions

V. Evaluate and Select

I. STATE THE PROBLEM in terms of a need to be satisfied rather than as a project to be made.

Examples:

"A writing, typing, drawing surface"--not--"A desk"
"A means of displaying photographs" --not--"A picture frame"
"A source of light for reading" --not--"A desk lamp"

Now you add three of your own needs properly stated:

(1) _____

(2) _____

(3) _____

The statement of the problem in this manner accomplishes at least three important purposes:

A. It can bring out a variety of possible solutions. The student setting out to design a picture frame may conceive of different sizes and shapes of moldings, a variety of mat arrangements, and several methods of installing glass, but all will be basically one solution-a picture frame. A photo cube for displaying photographs would never have been considered.

B. It adds purpose to designing. Various parts of the design will be dictated by some purpose to be served in the satisfaction of the need, not just on the basis of "I like it."

C. It forms a basis for evaluation. Various aspects of the design can be judged on how well they contribute to the satisfaction of the need. The evaluation can be more objective.

II. DEFINE THE PROBLEM by asking questions about the stated need. These may be served to clarify the need and may well bring about a modification of the need or point out that it is really not a need at all. It can point up other needs.

A. Keep several points in mind when writing the questions.

1. Start by questioning basic ideas rather than minor specific details.

Examples:
a. "How can books be supported?"
b. "What are the characteristics of a good writing surface?"
c. "What volume of soil is needed to grow a given plant?"

Now you add three questions, one about each of the needs which you stated on the previous page.

(1) _____

(2) _____

(3) _____

2. Make questions specific enough to bring out needed information.

Examples: a. "How many books will be stored?"
b. "What height is needed to hang up a top coat?"
c. "What is a comfortable reading position?"

Now you add three questions, one about each of the needs stated on the previous page.

(1) _____

(2) _____

(3) _____

3. Make questions general enough to call for basic research, not just "yes" or "no" answers.

Examples: a. "Who will use this article?"--not--"Will more than one person use this article?"
b. "Where will this device be used?"--not--"Will this device have to be portable?"
c. "What protection will be needed for the contents?"--not--"Will it have to be locked?"

Now you add three questions, one about each of the needs stated on the previous page.

(1) _____

(2) _____

(3) _____

4. Don't "beg the solution." Ask questions about the need rather than about some possible solution.

Examples: a. "What types of wear will it be subjected to?"--not--"What material should it be made from?"
b. "What size drawings will be made on this device?"--not--"What size should a drawing board be?"
c. "What size of shape restrictions are placed on it by the environment?"--not--"How big should it be?"

Now you write three questions, one about each of the needs stated on the previous page.

(1) _____

(2) _____

(3) _____

B. It may help to think of questions in groups. Possible groups might be:

1. Questions concerning the use.

   Examples: a. "How many fishing rods will be carried?"
   b. "What environmental conditions will it be subjected to?"

   Now you write three questions, one about each of the needs stated in the first section.

   (1) _____

   (2) _____

   (3) _____

2. Questions concerning the user.

   Examples: a. "How high can an average housewife reach?"
   b. "How large must letters be to be read from ten feet?"
   c. "What colors will attract a five-year old child?"

   Now you write three questions, one about each of the needs stated in the first section.

   (1) _____

   (2) _____

   (3) _____

3. Questions concerning the environment.

   Examples: a. "What is the general style of other furniture in the room?"
   b. "How much space is available in the kitchen for this device?"
   c. "What existing devices are there in the room on which this device can be supported?"

   Now you write three questions, one about each of the needs stated in the first section.

   (1) _____

   (2) _____

   (3) _____

III. CONDUCT RESEARCH on the problem by seeking answers to the questions. Make the answers as specific as possible, indicating dimensions where possible.

A. Some questions may be answered by the designer in terms of his own need.

Examples: 1. Where can guns be displayed in the home?

2. What are the sizes of the pictures to be mounted?

3. How many books will be kept at this desk?

B. Some questions may be answered by investigating resource materials.

Examples: 1. How high can the average housewife reach? (Studies like that reported in Dreyfuss. Designing for People, give facts that will help).

2. How much light is needed for reading? Typical sources may come from power companies. (The Better Light, Better Sight Bureau has several booklets of this type).

3. How large is various companion furniture? (Sources like Graphic Standards contain this kind of information).

C. Some questions may be answered by observation and experimentation.

Examples: 1. How can books be supported? (This may be answered by taking a group of books and trying various ideas).

2. How much space is needed for a study area? (This could be answered by taking the common amount of books, papers, etc,. and trying them out with several persons over a several-day period).

3. What are convenient methods of storing tools? (Students could observe others replacing and selecting tools in a cabinet).

Make a list of criteria (checklist) from the information (answers to the questions) you obtained by the research. Use the same format as the sample "Toolholder Check List" shown on the next page.

YES	NO	
		1. Toolholders should be sturdily constructed of durable material to withstand heavy, frequent use.
		2. A toolholder should be designed so that only the proper tool can be returned to the empty holder.
		3. A toolholder should protect the tool from damage or undue wear.
		4. A toolholder should be designed so that the tool can be replaced in one position only.
		5. A toolholder should facilitate the swift, easy removal and replacement of the tool: (a) the simplest means of tool removal is a straight off-the-holder motion: replacement is a straight on-the-holder motion. (b) the next simplest means of tool removal is an up-and-off the holder motion; replacement is a down-and-on the holder motion.
		6. A toolholder should support the tool firmly so it cannot be jarred from its proper place by shop vibration, opening or closing doors, etc.
		7. A toolholder should permit quick and easy identification and selection of sized tools.
		8. A toolholder should require simple installation (preferably from the front) to facilitate easy replacement or relocation.
		9. A toolholder should be designed to facilitate a brief visual inspection for missing parts of the tool.
		10. A toolholder should offer the maximum safety protection to those who use the panel.
		11. A toolholder which supports one of several tools of the same size and type should be constructed so that any one of the designed tools will fit into it.
		12. A toolholder which supports more than one tool of the same size and type should have a means of indicating how many tools belong on this toolholder.
		13. A toolholder should support the tool so that its weight causes the tool to hang straight and in proper alignment.

*Adapted from: Pendered, Norman C., Principles for Arranging, Mounting and Storing Hand Tools in Industrial Arts Shops, A research study sponsored by the Central Fund for Research, The Pennsylvania State University, University Park, Pennsylvania (1959)

IV. PROPOSE POSSIBLE SOLUTIONS to the problem in terms of the need and research. Don't be too concerned at first with the practicality of individual proposals. The idea, at first, is to get a wide variety of possible solutions.

A. List as many solutions as possible with brief verbal statements.

Example: Need--"A writing surface"

Possible solutions:
hinged to wall
lap board
desk
board across two-drawer filing cases
pull-out shelf
bed table on pivoted pedestal
room divider
portable suitcase
note book

B. Sketch numerous ideas. Line sketches are good to get ideas on paper. Sketches of various details are useful. Once again, variety is the idea at first. Don't be too concerned early with minor details of appearance.

C. Make models and mock-ups from simulated materials or prototypes of working parts to try out ideas.

1. Scale models will give ideas of general proportions. These need not be working models. For instance, a cabinet may be represented by a block of wood with the door drawn in place rather than an actual scale model door.
2. Mock-ups may be made full size from cardboard or other similar materials to give an idea of size and shape.
3. Some parts (especially working parts) may be constructed full size and of the actual materials. This will give an analysis of the problems of manufacturers and a more realistic view of how they will look and operate.

V. EVALUATE AND SELECT the best solution in terms of the criterion sheet (checklist) which you developed from your research.

170-205 DESIGN FOR INDUSTRY
DESIGN PROBLEM II

NAME _____

A. Problem: Select a design problem from your area of expertise and/or interest (e.g. materials and processes, industrial graphics, power, etc.) and develop a solution for it.

B. Specific Requirements:

1. Select three problems which you would like to solve. State the three problems in terms of a need to be satisfied (e.g. a device to display photographs - not a picture frame). Present these three need statements to the instructor on/or before _____ for assessment and final approval. Be prepared to leave a copy on file with the instructor. You will work on only one of the approved needs.

Example Problems (Needs)

a. A method of providing comfortable seating for students around workbenches in the woodworking shop (or other shops).

b. A non-verbal (symbols) method of identifying the various industrial arts shops.

c. A device by which to cook food with the engine heat of an automobile while driving.

d. A device to hold a set of specified tools (e.g. a set of machinists tools).

e. A method of printing on cylindrical items (e.g. bottles, cans, etc.).

f. A method of utilizing waste materials (e.g. sawdust, steel shavings, paper, used oil) in a saleable product.

g. A method of storing energy generated in "down-hill runs" on a bicycle for use in "up-hill runs".

2. Prepare a list of at least twenty properly-stated questions about the selected and approved need. Consult "The Problem-Solving Approach to Design" booklet to develop appropriate questions. Give this list of questions to the instructor on/or before _____ for evaluation.
3. Rewrite any unsatisfactory questions (as determined by the instructor according to the criteria described in "The Problem-Solving Approach to Design" booklet) and resubmit them on/or before _____.
4. Obtain precise answers to all questions through research, observation and experimentation techniques.
5. Separate the information obtained by answering the questions into two categories: 1. Criterion factors
   2. Ideation factors
6. Develop a list of criterion (checklist) for the identified problem (need). Submit a copy of the criteria to the instructor for assessment and filing on/or before _____.
7. Propose a minimum of five <u>different</u> possible solutions to the problem via pictorial sketches.
8. Evaluate the possible solutions according to the specifications on the checklist. Identify how each proposed solution satisfies each of the specifications.
9. Select the best solution according to the above evaluation.
10. Work out all necessary details and develop a set of presentation sketches, drawings, models and/or mock-ups. Present your proposed solution to the class for preliminary evaluation on _____.
11. After re-evaluating the proposed solution on the bases of the suggestions provided by the class and after any necessary redesigning, construct a

complete prototype of the solution.

12. The designer will present his final prototype to the class on _____ _____.

13. Final evaluation will be made by the instructor according to the specification checklist and the Design Evaluation Sheet.

UNIVERSITY OF WISCONSIN-STOUT

Menomonie, Wisconsin 54751

J. Bjornerud

Design for Industry
170-205

NAME_____

EVALUATION

Directions: Each project will be evaluated by the student before it is given to the instructor for evaluation.

		STUDENT	INSTRUCTOR	COMMENTS
NEEDS ANALYSIS				
Thorough-complete investigation	12			
Moderately adequate-some investigation	8			
Inadequate-superficial investigation	4			
SIMPLICITY				
Simple-logical and direct solution	6			
Less Simple-more complicated than necessary	4			
Over-decorated-ornamented to be artistic and different	2			
HONESTY				
Honest-direct and practical use of materials	3			
Acceptable-fair use of materials	2			
Poor-imitation or wasting materials	1			
ORIGINALITY				
Original-creative and logical	6			
Modified-partially original	4			
Copy-stereotype or a copy	2			
WORKMANSHIP				
Good-sensitive	6			
Fair-acceptable	4			
Poor-reject	2			

		STUDENT	INSTRUCTOR	COMMENTS
FUNCTION				
Functional-clearly defined usefulness	9			
Questionable-some use	6			
Not functionable-little use	3			
STRUCTURE				
Sound Engineering-appropriate strength	3			
Fair Engineering-acceptable	2			
Poor Structure-weak or overstrength	1			
GENERAL APPEARANCE				
Appropriate-fits well in intended situation	3			
Questionable-not entirely appropriate	2			
Inappropriate-does not create desirable appearance	1			
ENVIRONMENTAL IMPACT				
Non-detrimental-completely recyclable and/or long lasting with little or no effort	6			
Slightly detrimental-not completely recyclable and/or long lasting	4			
Detrimental-not recyclable or long lasting without much energy expended	2			
STATE OF COMPLETION				
Complete-executed to completion	6			
Nearly complete-not quite completed	4			
Incomplete-much work yet to be done	2			
PRESENTATION				
Complete-all aspects covered well	6			
Acceptable-fairly well presented	4			
Inadequate-poorly covered	2			
CLASS VALUE ANALYSIS				
Superior	6			
Good (See Value Analysis	4			
Poor Evaluation Sheet)	2			
COMMENTS: TOTAL	72			

STUDENT INVOLVEMENT –

Some of the primary concerns in a program such as Research and Development deals with the methods used to bring about individual student involvement. How can students be guided to freer and more creative thought? How can students be instilled with a sense of power and accomplishment? How can a high level of student interest be brought about and maintained? How can students be instilled with the realization for the need of accuracy in research? How can the student be placed in the role of the researcher and/or developer?

Many of the vehicles now used in the teaching of industrial arts can be applied to the teaching of Research and Development. Industrial trips, films resource people, discussions-lectures and demonstrations all have their place, although the general complexion of these will very likely be different. Some additional methods that may be used are brainstorming, idea tracking and experimenting.

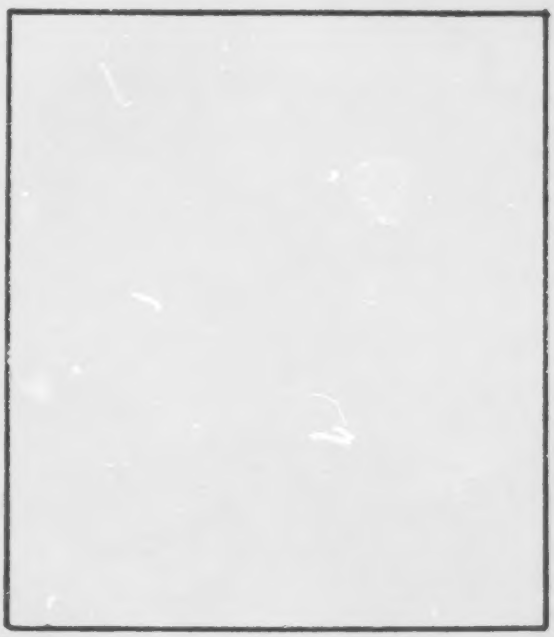
worthwhile research problems can come from several sources New processes and materials of industry can be studied. New equipment that is needed in the industrial arts laboratories may be developed. Problems that arise from manufacturing power technology, construction and courses in industrial arts that are just emerging will need to be answered. Many worthwhile problems may be brought in by the students from other areas of the school and their own realm of experiences.

The above considerations can give some answers to the first questions, but the real concern is the involving of the student as a researcher and/or developer. The study of the disciplines and technologies directly has been advocated by such leading educators as Brunner, Davis, Foshay and Phoenix to name a few. To accomplish this direct study it is necessary for the teacher and student to become aware of and function within the fundamental structure of research and development.

Creating Alternatives

You Are A Magazine Designer—

Create four different magazine cover sketches.
The name of your magazine is LEARNING
The theme of this issue is "Social Change."



Circle your first choice for a cover. Describe why you believe it is the best solution to your problem.

PRODUCT EVALUATION FORM

COLUMN I: List the criteria that you wish to consider.

COLUMN II: Decide on the relative importance of each of the criteria. In other words, give the most important criterion the highest rating of 4, and the least important criterion, a lower rating.

COLUMN III: Rate how the product quality meets each of the criteria. The better the quality, the higher (from 1 to 4) the rating should be.

COLUMN IV: Combine the importance rating of each criterion with the product quality rating by simply multiplying these two ratings. Calculate the overall rating by adding up the results listed in Column IV. Finally, to compare the overall value of a brand to its cost, divide the overall rating by cost. Record your answer in the relative value box.

The number in the last box is an indicator of how well the product will fit your needs. The greater the number is, the better the product should suit your budget and taste.

TYPE OF PRODUCT: _____

BRAND (and Model): _____ Best Price: _____

Criteria	II Relative Importance Rate 1 to 4	III Quality Rating Rate 1 to 4	IV Product of Multiplying II and III
		Overall rating = (Total of Column IV)	
RELATIVE VALUE = Overall rating / Best Price =			

DESIGNING FOR THE FUTURE

Modern Technology and Human Goals

The fruits of modern technolgy have had great impact upon our society. Our goals have become confused, probably because the seeds of technology have been too prolific. There are enormous numbers of goals to strive for. We have more services and goods available than ever before in history.

Transportation technology, for example, has changed the very structure of our society. Our society has now become very mobile. A change of jobs might cause a family to move far away from familiar friends and community. Most people will live in several places - perhaps even in several states - and change jobs or even the type of employment many times in their lifetime. We all routinely travel on visits and vacations. People even take a ride for weekend relaxation, with no particular destination in mind. As a result, traffic jams involving Sunday drivers are known from coast to coast.

There are many other characteristics besides mobility with which our culture can be described. For each of the following characteristics, write an example from your personal experience as an illustration. Try to be as specific as you can. Back up your opinions with some data!

1. Fashion fads and other gimmicks come and go quickly.

2. There are many competing brands, models, and qualities of many products.

3. Ours is a "throwaway" culture.

4. There are many package "experiences" - such as vacations, entertainment, dining out - that can be purchased.

5. Many different kinds of products can be rented.

6. We are being submerged by information sources such as billboards, posters, and street-corner leaflets.

7. Product advertising is carefully and expensively designed to appeal to us psychologically.

8. The introduction of new models of automobiles and large appliances is a regular annual occurrence.

RESOURCES:

Ready access to securing resources in developing an industrial education program are invaluable.

The resources included in the following section of the handbook include guides, texts, journals, educational games and simulations, companies and people.

The resources that are included are not meant to be all inclusive but rather were selected to get the curriculum developer off and running.

PUBLICATIONS

DeVore, Paul W., *Technology and the New Liberal Arts,* (Cedar Falls, Iowa: University of Northern Iowa).

Disclosure Document Program, U.S. Department of Commerce, Patent and Trademark Office (Washington, D.C.)

Department of Industrial Education and Technology, *Manufacturing Forum: Research and Development - Designing and Selecting Products* (Muncie, Indiana: Ball State University).

Education Research, *Planning* (Warren, New Jersey).

Gould, Inc., *The History, Economics and Impact of Technology and American Enterprise* (Dayton, Ohio).

The Industrial Education Instructional Materials Development Project, *An Introduction to Research and Development* (Menomonie, Wisconsin: University of Wisconsin-Stout).

Intellectual Property Owners, Inc., *The ABC's of Intellectual Property* (Washington, D. C.).

Jone, John, Ed., *Energy Activity Guide* (Portland, Oregon: Energy and Man's Environment, Inc.).

National Education Association, *To Make a Difference.*

Technology for Society, Theme for 1976-1977 (Menomonie, Wisconsin: University of Wisconsin-Stout).

ORGANIZATIONS

CENTER FOR STUDIES IN VOCATIONAL AND TECHNICAL EDUCATION
Box 49, 321 Education Building
University of Wisconsin
Madison, WI 53706

DEPARTMENT OF INDUSTRIAL EDUCATION AND TECHNOLOGY
Ball State University
Muncie, IN 47306

MIDWEST INVENTORS SOCIETY
310 Avenue A
Cloquet, MN 55720

MINNESOTA COMPUTER SOCIETY
Box 35317
Minneapolis, MN 55435

U. S. DEPARTMENT OF COMMERCE
Patent and Trademark Office
Washington, D. C. 20231

U. S. DEPARTMENT OF ENERGY
Washington, D. C. 20545

THE UNIVERSITY OF WISCONSIN-MILWAUKEE
Dr. Raymond H. Merritt, Director
Cultural & Technological Studies
EMS Building, Room W330
Milwaukee, WI 53201

UNIVERSITY OF WISCONSIN-STOUT
c/o Dr. James A. Bjornerud
School of Industry & Technology
Menomonie, WI 54751

VOCATIONAL EDUCATION RESOURCE MATERIALS
Center for Studies in Vocational & Technical Education
Box 49, 321 Education Building
University of Wisconsin
Madison, WI 53706
(List of resource materials)

BOOKS

Adam, James L. Conceptual Blockbusters - A Guide to Better Ideas (San Francisco: W.H. Freeman and Company) 1974.

Barr, George. Research Ideas for Young Scientists (New York: McGraw-Hill) 1958.

Dickerson, Steven L., and Joseph E. Robertshaw. Planning and Design (Lexington, Massachusetts: Lexington Books) 1975.

Earl, Arthur W. Experiments with Materials and Products of Industry (Bloomington, Illinois: McKnight & McKnight) 1960.

Gardner, Martin. "Aha! Insight," *Scientific American, Inc.* (San Francisco: W.H. Freeman and Company) 1978.

A Guide for Equipping Industrial Arts Facilities. (Washington, D. C.: American Industrial Arts Association) 1967.

Handbook of Homemade Power. *The Mother Earth News* (New York: Bantam Books, Inc.) 1974.

Hanks, . Design Yourself (Los Altos: William Kaufmann, Inc.) 1977.

Kleinmuntz, Benjamin, ed. Problem Solving (New York: John Wiley & Sons, Inc.) 1966.

Koberg, Don, and Jim Bagnall. The Universal Traveler (Los Altos: William Kaufmann, Inc.) 1974.

Leeds, Paul D. Practical Research, Planning and Design (New York: MacMillan Publishing Co., Inc.) 1974.

Lindbeck, John R. Designing Today's Manufactured Products (Bloomingtor, Illinois: McKnight & McKnight) 1972.

"The Man-Made World," *Engineering Concepts Curriculum Project (Three Parts)* (New York: McGraw-Hill) 1968.

Wickelgren, Wayne A. How to Solve Problems (San Francisco: W.H. Freeman and Company) 1974.

MAILING ADDRESSES FOR FILMS

FORD FILM LIBRARY - North American Automotive Operation
Ford Motor Company
The American Road
Dearborn, MI 48121

CONTEMPORARY/MCGRAW-HILL FILMS/ - Film Rental Libraries
Princeton Road
Hightstown, NJ 08520

PSYCHOLOGICAL FILMS - Administration Office
205 West 20th Street
Santa Ana, CA 92707

OHIO STATE UNIVERSITY-MOTION PICTURE DIVISION - 156 West 19th Ave.
Columbus, Ohio 43210

BNA COMMUNICATIONS INC. - 194 Decoverly Hall Road
Rockvill, MD 20850

PYRAMID FILMS - Box 1048
Santa Monica, CA 90406

CHURCHHILL FILMS - 662 North Robertson Blvd.
Los Angeles, CA 90028

CREATIVE EDUCATION FOUNDATION - State University College at Buffalo

FILM INC. - 1144 Wilmette Ave.
Wilmette, IL 60091

GENERAL MOTORS CORP. - Public Relations Staff
Film Library, General Motors Bldg.
Detroit, MI 48202

TIME-LIFE FILMS INC. - Distribution Center, Multimedia
100 Eisenhower Dr.
Paramus, NJ 07652

PERENNIAL EDUCATION INC. - 1825 Willow Road
Northfield, IL 60093

I/D/E/A - P.O. Box 446
Melbourne, FL 32901

INDUSTRIAL EDUCATION FILMS - P.O. Box 398
Harurch Port, MA 02646

MODERN TALKING PICTURE - 1212 Avenue of the Americas
New York, NY 10036

****For More Information on Reference Material Consult the Guide for Creative Action****

INDIVIDUALS

BENSEN, M. James
School of Industry and Technology
University of Wisconsin-Stout
Menomonie, WI 54751

BJORNERUD, James A.
School of Industry and Technology
University of Wisconsin-Stout
Menomonie, WI 54751

GIANOLI, James A.
Clintonville Junior High School
Clintonville, WI 54929

HINTERBERGER, Ann Marie
State University College at Buffalo
Creative Studies
1300 Elmwood Avenue
Buffalo, NY 14222

STALLSMITH, Douglas D.
225 B Applied Arts Building
University of Wisconsin-Stout
Menomonie, WI 54751

VOBEJDA, Allen
Baldwin-Woodville High School
Baldwin, WI 54002

WILSON, John A.
Menomonie Senior High School
1715 Fifth Street West
Menomonie, WI 54751

MAGAZINES

"Brain Teaser," *School Shop*, November, 1978, p. 74.

"How GM Manages Its Billion Dollar R & D Program," *Business Week*, June 28, 1976, p. 54.

Inside R & D

Martin, Gordon E., "Research and Experimentation as a Content Area," *Man/Society/Technology*, March, 1975, p. 188.

"On Research and Graduate Education," *The Journal of Epsilon Pi Tau*, Vol. III, Number I, Spring, 1977.

"Where Private Industry Puts Its Research Money," *Business Week*, June 28, 1976, p. 62.

FILMS

Technology and Society Audio-Visual Resources Digest, The National Science Foundation, 102 Materials Research Laboratory (University Park, Pennsylvania: The Pennsylvania State University).

For other films, see the attached sheet:

"ADDITIONAL RESOURCES"

BUHL, H., Creative Engineering Design, Iowa State University Press, c1976 195pp

BROCKMAN J. & ROSENFELD, Real Time 1&2, Anchor Doubleday Press c1973

DEWEY,J., Art As Experience, Capricorn Book, NY 1934

DALEY, E., The Cone Of Experience, Audio Visual Methods, NY, Dryden Press, 1954

GABOR, D., Innovation, Oxford University Press, NY 1976

GORDON, POSE, Strange and Familiar, Porpoise Book, 1972

GORDON, POZE, Teaching is Listening, Porpoise Book, 1972

GUILFORD, J.P., Way Beyond The I.Q., Creative Education Foundation in association with Creative Synergetic Associates 1977 193pp

GARDNER.J., Self-Renewal, NY, Harper & Row, 1963

HEYMAN, M., Simulation Games For The Classroom, Bloomington, IN Phi Delta Kappa Education Foundation, 1975

KASPRZYK, S., Technology: A Theoretical Base for Industrial Arts Education, Michigan State University, 1971

KOESTLER, A., The Act of Creation, MacMillian Co., MY, 1964

KOBERG & BAGNALL, The Universal Travellor, W. Kaufmann Inc., 1973

MACKINNON, In Search of Human Effectiveness, Creative Education Foundation in association with Creative Synergetic Association, 1978 212pp

MOORE, A.D., Invention, Discovery, and Creativity, NY, Doubleday & Co., 1969

NOLLER, R., Scratching the Surface of Creative Problem Solving,D.O.K. Pub., 1977

OSBORN, A., Applied Imagination, NYC-Scribners, 1963

DEWEY, J., Experience and Education, NY, Collier Books, 1938

PAPANAK, V., Design For The Real World, Bantam Books. 1971, 371pp

PARNES, S., NOLLER, R., Guide to Creative Action, Scribners 1977 399pp

PARNES, S., NOLLER, R., Creative Actionbook, Scribners, 1977 399pp

PITTMAN, K.L., BIONDI, A.M. (ed), Have An Affair With Your Mind-Buffalo, DOK 1974

RAUDSEPP, E., Creative Growth Games, NY, Jove Publication Inc., 1977

AVAILABLE PUBLICATIONS

AMERICAN INVENTOR MAGAZINE 10310 Menhart Lane Cupertino, CA 95014	1st major magazine for inventors
ALAN SHAWN FEINSTEIN & ASSOCIATES 37-41 Alhambra Circle Cranston, RI 02905	investment counselor $10 yr.
FIELDS WITHIN FIELDS World Institute Council P.O. Box 34 Martinsville, NJ 08836	quarterly $10 indiv. $15 insti.
THE JOURNAL OF CREATIVE BEHAVIOR Creative Education Foundation Inc. State University College at Buffalo 1300 Elmwood Ave. Buffalo, NY 14222	quarterly $9 yr. $3 ea.

FILMS

* indicates good at all levels ** review first

WHY MAN CREATES (25) Pyramid Films

**Change-Training Teachers for Innovations (26) I/D/E/A

*Berfunkle (10) Perennial Education, Inc. (what is a word?)

*The Cosmic Zoom (8) Contemporary/McGraw-Hill Film

**The Creative Attitude (27) General Motors

**Developing More and Better Ideas (25) Industrial Education Film, Inc.

**Discovery and Experience (30 ea.-series of 6) contact E. Malony Time-Life Films Inc.

*The Dot and The Line (9) Films, Inc. (excellent to make a point)

**Effective Listening (5) (B/W) Industrial Education Films, Inc.

**Koestler on Creativity (40) Time-Life Films, Inc.

**Maslow and Self-Actualization (6) Psychological Films

*Problem-Solvers (20) Churchhill films design and innovation

**The Teacher and Technology (B/W) (49) Ohio State University-Motion Picture Div.

**Year 1999 A.D. (26) Ford Film Library

WHERE TO GO*** once the inventive idea is conceived...

INVENTORS OF BUFFALO/NY

INVENTORS OF ALBANY/NY

INVENTORS OF LANCASTER/PA

INVENTORS OF SCRATTON/PA

INVENTORS OF ATLANTA/GA

INVENTORS OF MIAMI/FL

INVENTORS OF SYRACUSE/NY

INVENTORS OF... is an outgrowth of a national organization called (III) International Inventors Incorporated...

They feel they are able to do a better less expensive job (1/3 cost) for the entrepreneur inventor

///SERVICES INCLUDE///

FREE CONSULTATION
PATENT SEARCH $175-$225 ...less than cost of a patent lawyer

or...

PATENT SEARCH ENGINEERING
STUDY MARKETING REPORT
DRAWINGS $495 it is then ready to go to the manufacturers for acceptance

OBTAIN PATENT $ 10

$500

BEWARE...some of the Invention Promotion Sales Companies that take the money and run--One of the largest got 30,000 people to send money to promote their ideas and inventions and only 3 out of the 30,000 made more than they put in...

Of course there are other companies...my intention here is to give you a springboard to start from...